Gratitude

In appreciation and gratitude

to The Custodian of the Two Holy Mosques

King Abdullah Bin Abdul Aziz Al Saud

And

H.R.H. Prince Sultan Bin Abdul Aziz Al Saud

Crown Prince, Deputy Premier, Minister of Defence

& Aviation and Inspector General

For their continuous support and gracious consideration,

the Saudi Building Code National Committee (SBCNC)

is honored to present the first issue of

the Saudi Building Code (SBC).

Saudi Building Code Requirements

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PREFACE

The Saudi Building Code (SBC) is a set of legal, administrative and technical regulations and requirements that specify the minimum standards of construction for building in order to ensure public safety and health. A Royal Decree dated 11^{th} June 2000 order the formation of a national committee composed of representatives of Saudi universities and governmental and private sectors. In September 2001, the Council of Ministers approved the general plan of the National Committee to develop a national building code for the Kingdom of Saudi Arabia.

To choose a base code for the Saudi Building Code, a number of Codes have been studied. The National Committee has been acquainted with the results of the national researches and the international codes from the U.S.A., Canada and Australia, also, the European Code, and Arab Codes. It has also sought the opinions of specialists in relevant Saudi universities, governmental and private sectors through holding a questionnaire, a symposium and specialized workshops, in the light of which, (ICC) has been chosen to be a base code for the Saudi Building Code.

The International Code Council (ICC) grants permission to the Saudi Building Code National Committee (SBCNC) to include all or any portion of material from the ICC codes, and standards in the SBC and ICC is not responsible or liable in any way to SBCNC or to any other party or entity for any modifications or changes that SBCNC makes to such documents.

Toward expanding the participation of all the specialists in the building and construction industry in the Kingdom through the governmental and private sectors, the universities and research centers, the National Committee took its own decisions related to code content by holding specialized meetings, symposiums and workshops and by the help of experts from inside and outside of Saudi Arabia.

The technical committees and sub-committees started their work in April 2003 to develop the Saudi Building Code that adapts the base code with the social and cultural environment, the natural and climatic conditions, types of soil and properties of materials in the Kingdom.

The Saudi Building Code Sanitary Requirements (SBC 701) was based on the *International Plumbing Code* (IPC).

The development process of SBC 701 followed the methodology approved by the Saudi Building Code National Committee. Many changes and modifications were made on the base code and only SI units were used throughout the Code. The changes were intended to compose a comprehensive set of provisions, to the best possible extent, for materials, environmental conditions, and construction practices prevailing in the Kingdom.

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DEFINITIONS

ACCEPTED ENGINEERING PRACTICE. That which conforms to accepted principles, tests or standards of nationally recognized technical or scientific authorities.

ACCESS (TO). That which enables a fixture, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel, door or similar obstruction (see “Ready access”).

ACCESS COVER. A removable plate, usually secured by bolts or screws, to permit access to a pipe or pipe fitting for the purposes of inspection, repair or cleaning.

ADAPTER FITTING. An approved connecting device that suitably and properly joins or adjusts pipes and fittings which do not otherwise fit together.

AGGREGATE. Graded hard rock that has been washed with water under pressure over a screen during or after grading to remove fine material and with a hardness value of 3 or greater on Mohs’ Scale of Hardness. Aggregate that will scratch a copper penny without leaving any residual rock material on the coin has a hardness value of 3 or greater on Mohs’ Scale of Hardness.

AIR ADMITTANCE VALVE. One-way valve designed to allow air to enter the plumbing drainage system when negative pressures develop in the piping system. The device shall close by gravity and seal the vent terminal at zero differential pressure (no flow conditions) and under positive internal pressures. The purpose of an air admittance valve is to provide a method of allowing air to enter the plumbing drainage system without the use of a vent extended to open air and to prevent sewer gases from escaping into a building.

AIR BREAK (Drainage System). A piping arrangement in which a drain from a fixture, appliance or device discharges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim and above the trap seal.

AIR GAP (Drainage System). The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging.

AIR GAP (Water Distribution System). The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

ALLUVIUM. Soil deposited by floodwaters.

ALTERNATIVE ENGINEERED DESIGN. A plumbing system that performs in accordance with the intent of Chapters 1 through 6 and provides an equivalent level of performance for the protection of public health, safety and welfare. The system design is not specifically regulated by Chapters 1 through 6.

ANCHORS. See “Supports.”

ANTISIPHON. A term applied to valves or mechanical devices that eliminate siphonage.

APPROVED. Approved by the code official or other authority having jurisdiction.

APPROVED AGENCY. An established and recognized agency approved by the code official and that is regularly engaged in conducting tests or furnishing inspection services.

AREA DRAIN. A receptacle designed to collect surface or storm water from an open area.

ASPIRATOR. A fitting or device supplied with water or other fluid under positive pressure that passes through an integral orifice or constriction, causing a vacuum. Aspirators are also referred to as suction apparatus, and are similar in operation to an ejector.

BACKFLOW. Pressure created by any means in the water distribution system, which by being in excess of the pressure in the water supply mains causes a potential backflow condition.

Backpressure, low head. A pressure less than or equal to 29.88 kPa or the pressure exerted by 3050 mm column of water.

Backsiphonage. The backflow of potentially contaminated water into the potable water system as a result of the pressure in the potable water system falling below atmospheric pressure of the plumbing fixtures, pools, tanks or vats connected to the potable water distribution piping.

Backwater valve. A device or valve installed in the building drain or sewer pipe where a sewer is subject to backflow, and which prevents drainage or waste from backing up into a low level or fixtures and causing a flooding condition.

Drainage. A reversal of flow in the drainage system.

Water supply system. The flow of water or other liquids, mixtures or substances into the distribution pipes of a potable water supply from any source except the intended source.

BACKFLOW CONNECTION. Any arrangement whereby backflow is possible.

BACKFLOW PREVENTER. A device or means to prevent backflow.

BALL COCK. See “Fill Valve.”

BASE FLOOD ELEVATION. A reference point, determined in accordance with the building code, based on the depth or peak elevation of flooding, including wave height, which has a 1 percent (100-year flood) or greater chance of occurring in any given year.

BATHROOM GROUP. A group of fixtures consisting of a water closet, lavatory, bathtub or shower, including or excluding a bidet, an emergency floor drain or both. Such fixtures are located together on the same floor level.

BEDPAN STEAMER OR BOILER. A fixture utilized for scalding bedpans or urinals by direct application of steam or boiling water.

BEDPAN WASHER AND STERILIZER. A fixture designed to wash bedpans and to flush the contents into the sanitary drainage system. Included are fixtures of this type that provide for disinfecting utensils by scalding with steam or hot water.

BEDPAN WASHER HOSE. A device supplied with hot and coldwater and located adjacent to a water closet or clinical sink to be utilized for cleansing bedpans.

BEDROCK. The rock that underlies soil material or is located at the earth’s surface. Bedrock is encountered when the weathered in-place consolidated material, larger than 2 mm in size, is greater than 50 percent by volume.

BRANCH. Any part of the piping system except a riser, main or stack.

BRANCH INTERVAL. A distance along a soil or waste stack corresponding in general to a story height, but not less than 2438 mm, within which the horizontal branches from one floor or story of a structure are connected to the stack.

BRANCH VENT. A vent connecting one or more individual vents with a vent stack or stack vent.

BUILDING. Any structure occupied or intended for supporting or sheltering any occupancy.

BUILDING DRAIN. That part of the lowest piping of a drainage system that receives the discharge from soil, waste and other drainage pipes inside and that extends 762 mm in developed length of pipe beyond the exterior walls of the building and conveys the drainage to the building sewer.

Combined. A building drain that conveys both sewage and storm water or other drainage.
Sanitary. A building drain that conveys sewage only.
Storm. A building drain that conveys storm water or other drainage, but not sewage.

BUILDING SEWER. That part of the drainage system that extends from the end of the building drain and conveys the discharge to a public sewer, private sewer, individual sewage disposal system or other point of disposal.

Combined. A building sewer that conveys both sewage and storm water or other drainage.
Sanitary. A building sewer that conveys sewage only.
Storm. A building sewer that conveys storm water or other drainage, but not sewage.

BUILDING SUBDRAIN. That portion of a drainage system that does not drain by gravity into the building sewer.

BUILDING TRAP. A device, fitting or assembly of fittings installed in the building drain to prevent circulation of air between the drainage system of the building and the building sewer.

CESSPOOL. A covered excavation in the ground receiving sewage or other organic wastes from a drainage system, and is designed to retain the organic matter and solids, permitting the liquids to seep into the soil cavities.

CIRCUIT VENT. A vent that connects to a horizontal drainage branch and vents two traps to a maximum of eight traps or trapped fixtures connected into a battery.

CISTERN. A small covered tank for storing water for a home or farm. Generally, this tank stores rainwater to be utilized for purposes other than in the potable water supply, and such tank is placed underground in most cases.

CLEANOUT. An access opening in the drainage system utilized for the removal of obstructions. Types of cleanouts include a removable plug or cap, and a removable fixture or fixture trap.

CLEAR-WATER WASTES. Cooling water and condensate drainage from refrigeration compressors and air-conditioning equipment, water used for equipment chilling purposes, liquid having no impurities or where impurities have been reduced below a minimum

concentration considered harmful and cooled condensate from steam-heating systems or other equipment.

CODE. These requirements, subsequent amendments thereto, or any emergency rule or regulation lawfully adopted.

CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

COLLUVIUM. Soil transported under the influence of gravity.

COLOR. The moist color of the soil based on Munsell soil color charts.

COMBINATION FIXTURE. A fixture combining one sink and laundry tray or a two- or three-compartment sink or laundry tray in one unit.

COMBINATION WASTE AND VENT SYSTEM. A specially designed system of waste piping embodying the horizontal wet venting of one or more sinks or floor drains by means of a common waste and vent pipe adequately sized to provide free movement of air above the flow line of the drain.

COMBINED BUILDING DRAIN. See “Building drain, combined.”

COMBINED BUILDING SEWER. See “Building sewer, combined.”

COMMON VENT. A vent connecting at the junction of two fixture drains or to a fixture branch and serving as a vent for both fixtures.

CONCEALED FOULING SURFACE. Any surface of a plumbing fixture which is not readily visible and is not scoured or cleansed with each fixture operation.

CONSTRUCTION DOCUMENTS. All the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a building permit. The construction drawings shall be drawn to an appropriate scale.

CONDUCTOR. A pipe inside the building that conveys storm water from the roof to a storm or combined building drain.

CONSTRUCTION DOCUMENTS. All of the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a building permit. The construction drawings shall be drawn to an appropriate scale.

CONTAMINATION. An impairment of the quality of the potable water that creates an actual hazard to the public health through poisoning or through the spread of disease by sewage, industrial fluids or waste.

CONVENTIONAL SOIL ABSORPTION SYSTEM. A system employing gravity flow from the septic or other treatment tank and applying effluent to the soil through the use of a seepage trench, bed or pit.

CRITICAL LEVEL (C-L). An elevation (height) reference point that determines the minimum height at which a backflow preventer or vacuum breaker is installed above the flood level rim of the fixture or receptor served by the device. The critical level is the elevation level below which there is a potential for backflow to occur. If the critical level marking is not indicated on the device, the bottom of the device shall constitute the critical level.

CROSS CONNECTION. Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other either water of unknown or questionable safety or steam, gas or chemical, whereby there exists the possibility for flow from one system to the other, with the direction of flow depending on the pressure differential between the two systems (see "Backflow").

DEAD END. A branch leading from a soil, waste or vent pipe; a building drain; or a building sewer, and terminating at a developed length of 610 mm or more by means of a plug, cap or other closed fitting.

DEPTH OF WATER SEAL. The depth of water that would have to be removed from a full trap before air could pass through the trap.

DESIGN FLOOD ELEVATION. The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map.

DETAILED SOIL MAP. A map prepared showing soil series, type and phases at a scale of not more than 610 m (2,000 feet) to the inch and which includes related explanatory information.

DEVELOPED LENGTH. The length of a pipeline measured along the centerline of the pipe and fittings.

DISCHARGE PIPE. A pipe that conveys the discharges from plumbing fixtures or appliances.

DOSING SOIL ABSORPTION SYSTEM. A system employing a pump or automatic siphon to elevate or distribute effluent to the soil through the use of a seepage trench or bed.

DRAIN. Any pipe that carries wastewater or water-borne wastes in a building drainage system.

DRAINAGE FITTINGS. Type of fitting or fittings utilized in the drainage system. Drainage fittings are similar to cast-iron fittings, except that instead of having a bell and spigot, drainage fittings are recessed and tapped to eliminate ridges on the inside of the installed pipe.

DRAINAGE FIXTURE UNIT

Drainage (DFU). A measure of the probable discharge into the drainage system by various types of plumbing fixtures. The drainage fixture-unit value for a particular fixture depends on its volume rate of drainage discharge, on the time duration of a single drainage operation and on the average time between successive operations.

DRAINAGE SYSTEM. Piping within a public or private premise that conveys sewage, rainwater or other liquid wastes to a point of disposal. A drainage system does not include the mains of a public sewer system or a private or public sewage treatment or disposal plant.

Building gravity. A drainage system that drains by gravity into the building sewer.

Sanitary. A drainage system that carries sewage and excludes storm, surface and ground water.

Storm. A drainage system that carries rainwater, surface water, subsurface water and similar liquid wastes.

EFFECTIVE OPENING. The minimum cross-sectional area at the point of water supply discharge, measured or expressed in terms of the diameter of a circle or, if the opening is not circular, the diameter of a circle of equivalent cross-sectional area. For faucets and similar fittings, the effective opening shall be measured at the smallest orifice in the fitting body or in the supply piping to the fitting.

EFFLUENT. Liquid discharged from a septic or other treatment tank.

EMERGENCY FLOOR DRAIN. A floor drain that does not receive the discharge of any drain or indirect waste pipe, and that protects against damage from accidental spills, fixture overflows and leakage.

ESSENTIALLY NONTOXIC TRANSFER FLUIDS. Fluids having a Gosselin rating of 1, including propylene glycol; mineral oil; polydimethylsiloxane; hydrochlorofluorocarbon, chlorofluorocarbon and carbon refrigerants; and FDA-approved boiler water additives for steam boilers.

ESSENTIALLY TOXIC TRANSFER FLUIDS. Soil, waste or gray water and fluids having a Gosselin rating of 2 or more including ethylene glycol, hydrocarbon oils, ammonia refrigerants and hydrazine.

EXISTING INSTALLATIONS. Any plumbing system regulated by this code that was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

FAUCET. A valve end of a water pipe through which water is drawn from or held within the pipe.

FILL VALVE. A water supply valve, opened or closed by means of a float or similar device, utilized to supply water to a tank. An antisiphon fill valve contains an antisiphon device in the form of an approved air gap or vacuum breaker that is an integral part of the fill valve unit and that is positioned on the discharge side of the water supply control valve.

FIXTURE. See “Plumbing fixture.”

FIXTURE BRANCH. A drain serving two or more fixtures that discharges to another drain or to a stack.

FIXTURE DRAIN. The drain from the trap of a fixture to a junction with any other drain pipe.

FIXTURE FITTING

Supply fitting. A fitting that controls the volume and/or directional flow of water and is either attached to or accessible from a fixture, or is used with an open or atmospheric discharge.

Waste fitting. A combination of components that conveys the sanitary waste from the outlet of a fixture to the connection to the sanitary drainage system.

FIXTURE SUPPLY. The water supply pipe connecting a fixture to a branch water supply pipe or directly to a main water supply pipe.

FLOOD LEVEL RIM. The edge of the receptacle from which water overflows.

FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any given year.
2. The area designated as a flood hazard area on a community's flood hazard map or as otherwise legally designated.

FLOW PRESSURE. The pressure in the water supply pipe near the faucet or water outlet while the faucet or water outlet is wide open and flowing.

FLUSH TANK. A tank designed with a ball cock and flush valve to flush the contents of the bowl or usable portion of the fixture.

FLUSHOMETER TANK. A device integrated within an air accumulator vessel that is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

FLUSHOMETER VALVE. A valve attached to a pressurized water supply pipe and so designed that when activated it opens the line for direct flow into the fixture at a rate and quantity to operate the fixture properly, and then gradually closes to reseal fixture traps and avoid water hammer.

GREASE INTERCEPTOR. A passive interceptor whose rated flow exceeds 200 L/m.

GREASE-LADEN WASTE. Effluent discharge that is produced from food processing, food preparation or other sources where grease, fats and oils enter automatic dishwater pre-rinse stations, sinks or other appurtenances.

GREASE TRAP. A passive interceptor whose rated flow is 200 L/m or less.

HANGERS. See "Supports."

HIGH GROUND WATER. Soil saturation zones, including perched water tables, shallow regional groundwater tables or aquifers, or zones seasonally, periodically or permanently saturated.

HOLDING TANK. An approved water-tight receptacle for collecting and holding sewage.

HORIZONTAL BRANCH DRAIN. A drainage branch pipe extending laterally from a soil or waste stack or building drain, with or without vertical sections or branches, that receives the discharge from two or more fixture drains or branches and conducts the discharge to the soil or waste stack or to the building drain.

HORIZONTAL REFERENCE POINT. A stationary, easily identifiable point to which horizontal dimensions are related.

HORIZONTAL PIPE. Any pipe or fitting that makes an angle of less than 45 degrees with the horizontal.

HOT WATER. Water at a temperature greater than or equal to 43°C.

HOUSE TRAP. See "Building trap."

INDIRECT WASTE PIPE. A waste pipe that does not connect directly with the drainage system, but that discharges into the drainage system through an air break or air gap into a trap, fixture, receptor or interceptor.

INDIVIDUAL SEWAGE DISPOSAL SYSTEM. A system for disposal of domestic sewage by means of a septic tank, cesspool or mechanical treatment, designed for utilization apart from a public sewer to serve a single establishment or building.

INDIVIDUAL VENT. A pipe installed to vent a fixture trap and connects with the vent system above the fixture served or terminates in the open air.

INDIVIDUAL WATER SUPPLY. A water supply that serves one or more families and that is not an approved public water supply.

INTERCEPTOR. A device designed and installed to separate and retain for removal, by automatic or manual means, deleterious, hazardous or undesirable matter from normal wastes, while permitting normal sewage or wastes to discharge into the drainage system by gravity.

JOINT

Expansion. A loop, return bend or return offset that provides for the expansion and contraction in a piping system and is utilized in tall buildings or where there is a rapid change of temperature, as in power plants, steam rooms and similar occupancies.

Flexible. Any joint between two pipes that permits one pipe to be deflected or moved without movement or deflection of the other pipe.

Mechanical. See "Mechanical joint."

Slip. A type of joint made by means of a washer or a special type of packing compound in which one pipe is slipped into the end of an adjacent pipe.

LEAD-FREE PIPE AND FITTINGS. Containing not more than 8.0-percent lead.

LEAD-FREE SOLDER AND FLUX. Containing not more than 0.2-percent lead.

LEADER. An exterior drainage pipe for conveying storm water from roof or gutter drains to an approved means of disposal.

LEGAL DESCRIPTION. An accurate metes and bounds description, a lot and block number in a recorded subdivision, a recorded assessor's plat or a public land survey description to the nearest 16 ha.

LOCAL VENT STACK. A vertical pipe to which connections are made from the fixture side of traps and through which vapor or foul air is removed from the fixture or device utilized on bedpan washers.

MACERATING TOILET SYSTEMS. An assembly consisting of a water closet and sump with a macerating pump that is designed to collect, grind and pump wastes from the water closet and up to two other fixtures connected to the sump.

MAIN. The principal pipe artery to which branches are connected.

MANHOLE. An opening of sufficient size to permit a person to gain access to a sewer or any portion of a private sewage disposal system.

MANIFOLD. See “Plumbing appurtenance.”

MECHANICAL JOINT. A connection between pipes, fittings, or pipes and fittings that is not screwed, caulked, threaded, soldered, solvent cemented, brazed or welded. A joint in which compression is applied along the centerline of the pieces being joined. In some applications, the joint is part of a coupling, fitting or adapter.

MEDICAL GAS SYSTEM. The complete system to convey medical gases for direct patient application from central supply systems (bulk tanks, manifolds and medical air compressors), with pressure and operating controls, alarm warning systems, related components and piping networks extending to station outlet valves at patient use points.

MEDICAL VACUUM SYSTEMS. A system consisting of central-vacuum-producing equipment with pressure and operating controls, shutoff valves, alarm-warning systems, gauges and a network of piping extending to and terminating with suitable station inlets at locations where patient suction may be required.

MOBILE UNIT. A structure of vehicular, portable design, built on a chassis and designed to be moved from one site to another and to be used with or without a permanent foundation.

MOBILE UNIT PARK. Any plot or plots of ground owned by a person, state or local government upon which two or more units, occupied for dwelling or sleeping purposes regardless of mobile unit ownership, are located and whether or not a charge is made for such accommodation.

NONPOTABLE WATER. Water not safe for drinking, personal or culinary utilization.

NUISANCE. Public nuisance as known in common law or in equity jurisprudence; whatever is dangerous to human life or detrimental to health; whatever structure or premises is not sufficiently ventilated, sewered, drained, cleaned or lighted, with respect to its intended occupancy; and whatever renders the air, or human food, drink or water supply unwholesome.

OCCUPANCY. The purpose for which a building or portion thereof is utilized or occupied.

OFFSET. A combination of approved bends that makes two changes in direction bringing one section of the pipe out of line but into a line parallel with the other section.

OPEN AIR. Outside the structure.

PAN. A soil horizon cemented with any one of a number of cementing agents such as iron, organic matter, silica, calcium, carbonate, gypsum or a combination of chemicals. Pans will resist penetration from a knife blade and are slowly permeable horizons or are impermeable.

PERCOLATION TEST. The method of testing absorption qualities of the soil (see Section 7.2.9).

PERMEABILITY. The ease with which liquids move through the soil. One of the soil qualities listed in soil survey reports.

PLUMBING. The practice, materials and fixtures utilized in the installation, maintenance, extension and alteration of all piping, fixtures, plumbing appliances and plumbing appurtenances, within or adjacent to any structure, in connection with sanitary drainage or storm drainage facilities; venting systems; and public or private water supply systems.

PLUMBING APPLIANCE. Any one of a special class of plumbing fixtures intended to perform a special function. Included are fixtures having the operation or control dependent on one or more energized components, such as motors, controls, heating elements, or pressure- or temperature-sensing elements. Such fixtures are manually adjusted or controlled by the owner or operator, or are operated automatically through one or more of the following actions: a time cycle, a temperature range, a pressure range, a measured volume or weight.

PLUMBING APPURTENANCE. A manufactured device, prefabricated assembly or an on-the-job assembly of component parts that is an adjunct to the basic piping system and plumbing fixtures. An appurtenance demands no additional water supply and does not add any discharge load to a fixture or to the drainage system.

PLUMBING FIXTURE. A receptacle or device that is either permanently or temporarily connected to the water distribution system of the premises and demands a supply of water there from; discharges wastewater, liquid-borne waste materials or sewage either directly or indirectly to the drainage system of the premises; or requires both a water supply connection and a discharge to the drainage system of the premises.

PLUMBING SYSTEM. Includes the water supply and distribution pipes; plumbing fixtures and traps; water-treating or water-using equipment; soil, waste and vent pipes; and sanitary and storm sewers and building drains; in addition to their respective connections, devices and appurtenances within a structure or premises.

POLLUTION. An impairment of the quality of the potable water to a degree that does not create a hazard to the public health but that does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use.

POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming to the bacteriological and chemical quality requirements of the Public Health Service Drinking Water Standards or the regulations of the public health authority having jurisdiction.

PRESSURE DISTRIBUTION SYSTEM. A soil absorption system employing a pump or automatic siphon and smaller diameter distribution piping with small diameter perforations to introduce effluent into the soil.

PRIVATE SEWAGE DISPOSAL SYSTEM. A sewage treatment and disposal system serving a single structure with a septic tank and soil absorption field located on the same parcel as the structure. This term also means an alternative sewage disposal system, including a substitute for the septic tank or soil absorption field, a holding tank, a system serving more than one structure or a system located on a different parcel than the structure. A private

sewage disposal system is permitted to be owned by the property owner or a special-purpose district.

PRIVY. A structure not connected to a plumbing system and which is used by persons for the deposition of human body waste.

PRIVATE. In the classification of plumbing fixtures, "private" applies to fixtures in residences and apartments, and to fixtures in nonpublic toilet rooms of hotels and motels and similar installations in buildings where the plumbing fixtures are intended for utilization by a family or an individual.

PUBLIC OR PUBLIC UTILIZATION. In the classification of plumbing fixtures, "public" applies to fixtures in general toilet rooms of schools, gymnasiums, hotels, airports, bus and railroad stations, public buildings, bars, public comfort stations, office buildings, stadiums, stores, restaurants and other installations where a number of fixtures are installed so that their utilization is similarly unrestricted.

PUBLIC WATER MAIN. A water supply pipe for public utilization controlled by public authority.

QUICK-CLOSING VALVE. A valve or faucet that closes automatically when released manually or that is controlled by a mechanical means for fast-action closing.

READY ACCESS. That which enables a fixture, appliance or equipment to be directly reached without requiring the removal or movement of any panel, door or similar obstruction and without the use of a portable ladder, step stool or similar device.

REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER. A backflow prevention device consisting of two independently acting check valves, internally force-loaded to a normally closed position and separated by an intermediate chamber (or zone) in which there is an automatic relief means of venting to the atmosphere, internally loaded to a normally open position between two tightly closing shutoff valves and with a means for testing for tightness of the checks and opening of the relief means.

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice professional architecture or engineering as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

RELIEF VALVE

Pressure relief valve. A pressure-actuated valve held closed by a spring or other means and designed to relieve pressure automatically at the pressure at which such valve is set.

Temperature and pressure relief (T&P) valve. A combination relief valve designed to function as both a temperature relief and a pressure relief valve.

Temperature relief valve. A temperature-actuated valve designed to discharge automatically at the temperature at which such valve is set.

RELIEF VENT. A vent whose primary function is to provide circulation of air between drainage and vent systems.

RIM. An unobstructed open edge of a fixture.

RISER. See "Water pipe, riser."

ROOF DRAIN. A drain installed to receive water collecting on the surface of a roof and to discharge such water into a leader or a conductor.

ROUGH-IN. Parts of the plumbing systems that are installed prior to the installation of fixtures. This includes drainage, water supply, vent piping and the necessary fixture supports and any fixtures that are built into the structure.

SEEPAGE BED. An excavated area larger than 1500 mm in width that contains a bedding of aggregate and has more than one distribution line.

SEEPAGE PIT. An underground receptacle constructed to permit disposal of effluent or clear wastes by soil absorption through its floor and walls.

SEEPAGE TRENCH. An area excavated 300 mm to 1500 mm in width containing a bedding of aggregate and a single distribution line.

SELF-CLOSING FAUCET. A faucet containing a valve that automatically closes upon deactivation of the opening means.

SEPARATOR. See "Interceptor."

SEPTAGE. All sludge, scum, liquid and any other material removed from a private sewage treatment and disposal system.

SEPTIC TANK. A tank that receives and partially treats sewage through processes of sedimentation, flotation and bacterial action so as to separate solids from the liquid in the sewage, and which discharges the liquid to a soil absorption system.

SEWAGE. Any liquid waste containing animal or vegetable matter in suspension or solution, including liquids containing chemicals in solution.

SEWAGE EJECTORS. A device for lifting sewage by entraining the sewage in a high-velocity jet of steam, air or water.

SEWER

Building sewer. See "Building sewer."

Public sewer. A common sewer directly controlled by public authority.

Sanitary sewer. A sewer that carries sewage and excludes storm, surface and ground water.

Storm sewer. A sewer that conveys rainwater, surface water, subsurface water and similar liquid wastes.

SLOPE. The fall (pitch) of a line of pipe in reference to a horizontal plane. In drainage, the slope is expressed as the fall in units vertical per units horizontal (percent) for a length of pipe.

SOIL PIPE. A pipe that conveys sewage containing fecal matter to the building drain or building sewer.

SOIL. The unconsolidated material over bedrock, 2 mm and smaller.

SOIL BORING. An observation pit dug by hand or backhoe, a hole dug by augering or a soil core taken intact and undisturbed with a probe.

SOIL MOTTLES. Spots, streaks or contrasting soil colors usually caused by soil saturation for one period of a normal year, with a color value of 4 or more and a chroma of 2 or less. Gray-colored mottles are called low chroma; reddish-brown, red- and yellow-colored mottles are called high chroma.

SOIL SATURATION. The state when all pores in a soil are filled with water. Water will flow from saturated soil into a bore hole.

SPILLPROOF VACUUM BREAKER. An assembly consisting of one check valve force-loaded closed and an air-inlet vent valve force-loaded open to atmosphere, positioned downstream of the check valve, and located between and including two tightly closing shutoff valves and a test cock.

STACK. A general term for any vertical line of soil, waste, vent or inside conductor piping that extends through at least one story with or without offsets.

STACK VENT. The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

STACK VENTING. A method of venting a fixture or fixtures through the soil or waste stack.

STERILIZER

Boiling type. A boiling-type sterilizer is a fixture of a non pressure type utilized for boiling instruments, utensils or other equipment for disinfection. These devices are portable or are connected to the plumbing system.

Instrument. A device for the sterilization of various instruments.

Pressure (autoclave). A pressure vessel fixture designed to utilize steam under pressure for sterilizing.

Pressure instrument washer sterilizer. A pressure instrument washer sterilizer is a pressure vessel fixture designed to both wash and sterilize instruments during the operating cycle of the fixture.

Utensil. A device for the sterilization of utensils as utilized in health care services.

Water. A water sterilizer is a device for sterilizing water and storing sterile water.

STERILIZER VENT. A separate pipe or stack, indirectly connected to the building drainage system at the lower terminal that receives the vapors from non pressure sterilizers, or the exhaust vapors from pressure sterilizers, and conducts the vapors directly to the open air. Also called vapor, steam, atmospheric or exhaust vent.

STORM DRAIN. See “Drainage system, storm.”

STRUCTURE. That which is built or constructed or a portion thereof.

SUBSOIL DRAIN. A drain that collects subsurface water or seepage water and conveys such water to a place of disposal.

SUMP. A tank or pit that receives sewage or liquid waste, located below the normal grade of the gravity system and that must be emptied by mechanical means.

SUMP PUMP. An automatic water pump powered by an electric motor for the removal of drainage, except raw sewage, from a sump, pit or low point.

SUMP VENT. A vent from pneumatic sewage ejectors, or similar equipment, that terminates separately to the open air.

SUPPORTS. Devices for supporting and securing pipe, fixtures and equipment.

SWIMMING POOL. Any structure, basin, chamber or tank containing an artificial body of water for swimming, diving or recreational bathing having a depth of 610 mm or more at any point.

TEMPERED WATER. Water having a temperature range between 29°C and 43°C.

THIRD-PARTY CERTIFICATION AGENCY. An approved agency operating a product or material certification system that incorporates initial product testing, assessment and surveillance of a manufacturer's quality control system.

THIRD-PARTY CERTIFIED. Certification obtained by the manufacturer indicating that the function and performance characteristics of a product or material have been determined by testing and ongoing surveillance by an approved third-party certification agency. Assertion of certification is in the form of identification in accordance with the requirements of the third-party certification agency.

THIRD-PARTY TESTED. Procedure by which an approved testing laboratory provides documentation that a product, material or system conforms to specified requirements.

TRAP. A fitting or device that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or wastewater through the trap.

TRAP SEAL. The vertical distance between the weir and the top of the dip of the trap.

UNSTABLE GROUND. Earth that does not provide a uniform bearing for the barrel of the sewer pipe between the joints at the bottom of the pipe trench.

VACUUM. Any pressure less than that exerted by the atmosphere.

VACUUM BREAKER. A type of backflow preventer installed on openings subject to normal atmospheric pressure that prevents backflow by admitting atmospheric pressure through ports to the discharge side of the device.

VENT CAP. An approved appurtenance used for covering the vent terminal of an effluent disposal system to avoid closure by mischief or debris and still permit circulation of air within the system.

VERTICAL ELEVATION REFERENCE POINT. An easily identifiable stationary point or object of constant elevation for establishing the relative elevation of percolation tests, soil borings and other locations.

VENT PIPE. See “Vent system.”

VENT STACK. A vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system.

VENT SYSTEM. A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

VERTICAL PIPE. Any pipe or fitting that makes an angle of 45 degrees or more with the horizontal.

WALL-HUNG WATER CLOSET. A wall-mounted water closet installed in such a way that the fixture does not touch the floor.

WASTE. The discharge from any fixture, appliance, area or appurtenance that does not contain fecal matter.

WASTE PIPE. A pipe that conveys only waste.

WATER COURSE. A stream usually flowing in a particular direction, though it need not flow continually and is sometimes dry. A watercourse flows in a definite channel, with a bed, sides or banks, and usually discharges itself into some other stream or body of water. It must be something more than mere surface drainage over the entire face of a tract of land, occasioned by unusual freshets or other extraordinary cause. It does not include the water flowing in the hollows or ravines in land, which is the mere surface water from rains or melting snows, and is discharged through them from a higher to a lower level, but which at other times are destitute of water. Such hollows or ravines are not, in legal contemplation, watercourses.

WATER-HAMMER ARRESTOR. A device utilized to absorb the pressure surge (water hammer) that occurs when water flow is suddenly stopped in a water supply system.

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

WATER MAIN. A water supply pipe or system of pipes, installed and maintained by a city, township, county, public utility company or other public entity, on public property, in the street or in an approved dedicated easement of public or community use.

WATER OUTLET. A discharge opening through which water is supplied to a fixture, into the atmosphere (except into an open tank that is part of the water supply system), to a boiler or heating system, or to any devices or equipment requiring water to operate but which are not part of the plumbing system.

WATER PIPE

Riser. A water supply pipe that extends one full story or more to convey water to branches or to a group of fixtures.

Water distribution pipe. A pipe within the structure or on the premises that conveys water from the water service pipe, or from the meter when the meter is at the structure, to the points of utilization.

Water service pipe. The pipe from the water main or other source of potable water supply, or from the meter when the meter is at the public right of way, to the water distribution system of the building served.

WATER SUPPLY SYSTEM. The water service pipe, water distribution pipes, and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the structure or premises.

WELL

Bored. A well constructed by boring a hole in the ground with an auger and installing a casing.

Drilled. A well constructed by making a hole in the ground with a drilling machine of any type and installing casing and screen.

Driven. A well constructed by driving a pipe in the ground. The drive pipe is usually fitted with a well point and screen.

Dug. A well constructed by excavating a large-diameter shaft and installing a casing.

WHIRLPOOL BATHTUB. A plumbing appliance consisting of a bathtub fixture that is equipped and fitted with a circulating piping system designed to accept, circulate and discharge bathtub water upon each use.

WORKMANSHIP. Work of such character that will fully secure the results sought in all the sections of this code as intended for the health, safety and welfare protection of all individuals.

YOKE VENT. A pipe connecting upward from a soil or waste stack to a vent stack for the purpose of preventing pressure changes in the stacks.

CHAPTER 1
GENERAL REGULATIONS

SECTION 1.1
GENERAL

1.1.1 **Scope.** The provisions of this chapter shall govern the general regulations regarding the installation of plumbing not specific to other chapters.

1.1.2 **System installation**. Plumbing shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls and other surfaces through fixture usage.

1.1.3 **Connections to the sanitary drainage system**. All plumbing fixtures, drains, appurtenances and appliances used to receive or discharge liquid wastes or sewage shall be directly connected to the sanitary drainage system of the building or premises, in accordance with these requirements SBC 701. This section shall not be construed to prevent the indirect waste systems required by Sections 4.16 and 4.17.

1.1.4 **Connections to water supply.** Every plumbing fixture, device or appliance requiring or using water for its proper operation shall be directly or indirectly connected to the water supply system in accordance with the provisions of these requirements SBC 701.

1.1.5 **Pipe, tube and fitting sizes**. Unless otherwise specified, the pipe, tube and fitting sizes specified in these requirements SBC 701 are expressed in nominal or standard sizes as designated in the referenced material standards.

1.1.6 **Prohibited locations**. Plumbing systems shall not be located in an elevator shaft or in an elevator equipment room.
Exception: Floor drains, sumps and sump pumps shall be permitted at the base of the shaft provided they are indirectly connected to the plumbing system.

1.1.7 **Conflicts.** Where conflicts between these requirements SBC 701 and the conditions of the listing or the manufacturer's installation instructions occur, the provisions of this code apply.
Exception: Where a code provision is less restrictive than the conditions of the listing of the equipment or appliance or the manufacturer's installation instructions, the conditions of the listing and manufacturer's installation instructions shall apply.

SECTION 1.2
EXCLUSION OF MATERIALS DETRIMENTAL TO THE SEWER SYSTEM

1.2.1 **Detrimental or dangerous materials.** Ashes, cinders or rags; flammable, poisonous or explosive liquids or gases; oil, grease or any other insoluble material capable of obstructing, damaging or overloading the building drainage or sewer system, or capable of interfering with the normal operation of the sewage treatment processes, shall not be deposited, by any means, into such systems.

1.2.2 **Industrial wastes.** Waste products from manufacturing or industrial operations shall not be introduced into the public sewer until it has been determined by the code official or other authority having jurisdiction that the introduction thereof will not damage the public sewer system or interfere with the functioning of the sewage treatment plant.

SECTION 1.3 MATERIALS

1.3.1 **Identification.** Each length of pipe and each pipe fitting, trap, fixture, material and device utilized in a plumbing system shall bear the identification of the manufacturer.

1.3.2 **Installation of materials**. All materials used shall be installed in strict accordance with the standards under which the materials are accepted and approved. In the absence of such installation procedures, the manufacturer's installation instructions shall be followed. Where the requirements of referenced standards or manufacturer's installation instructions do not conform to minimum provisions of these requirements SBC 701, the provisions of this code shall apply.

1.3.3 **Plastic pipe, fittings and components**. All plastic pipe, fittings and components shall be third-party certified as conforming to NSF 14.

1.3.4 **Third-party testing and certification**. All plumbing products and materials shall comply with the referenced standards, specifications and performance criteria of these requirements SBC 701 and shall be identified in accordance with Section 1.3.1. When required by Table 1.3.4, plumbing products and materials shall either be tested by an approved third-party testing agency or certified by an approved third-party certification agency.

TABLE 1.3.4
PRODUCTS AND MATERIALS REQUIRING THIRD-PARTY TESTING AND THIRD-PARTY CERTIFICATION

PRODUCT OR MATERIAL	THIRD-PARTY CERTIFIED	THIRD-PARTY TESTED
Portable water supply system components and potable water fixture fittings	Required	—
Sanitary drainage and vent system components	Plastic pipe, fittings and pipe-related components	All others
Waste fixture fittings	Plastic pipe, fittings and pipe-related components	All others
Storm drainage system components	Plastic pipe, fittings and pipe-related components	All others
Plumbing fixtures	—	Required
Plumbing appliances	Required	—
Backflow prevention devices	Required	—
Water distribution system safety devices	Required	—
Special waste system components	—	Required
Subsoil drainage system components	—	Required

SECTION 1.4
RODENT PROOFING

1.4.1 **General.** Plumbing systems shall be designed and installed in accordance with Sections 1.4.2 through 1.4.4 to prevent rodents from entering structures.

1.4.2 **Strainer plates.** All strainer plates on drain inlets shall be designed and installed so that all openings are not greater than 13 mm in least dimension.

1.4.3 **Meter boxes.** Meter boxes shall be constructed in such a manner that rodents are prevented from entering a structure by way of the water service pipes connecting the meter box and the structure.

1.4.4 **Openings for pipes.** In or on structures where openings have been made in walls, floors or ceilings for the passage of pipes, such openings shall be closed and protected by the installation of approved metal collars that are securely fastened to the adjoining structure.

SECTION 1.5
PROTECTION OF PIPES AND PLUMBING SYSTEM COMPONENTS

1.5.1 **Corrosion.** Pipes passing through concrete or cinder walls and floors or other corrosive material shall be protected against external corrosion by a protective sheathing or wrapping or other means that will withstand any reaction from the lime and acid of concrete, cinder or other corrosive material. Sheathing or wrapping shall allow for expansion and contraction of piping to prevent any rubbing action. Minimum wall thickness of material shall be 0.65 mm.

1.5.2 **Breakage**. Pipes passing through or under walls shall be protected from breakage.

1.5.3 **Stress and strain**. Piping in a plumbing system shall be installed so as to prevent strains and stresses that exceed the structural strength of the pipe. Where necessary, provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement.

1.5.4 **Sleeves**. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the Saudi Building Code Fire Protection Requirements SBC 801.

1.5.5 **Pipes through or under footings or foundation walls**. Any pipe that passes under a footing or through a foundation wall shall be provided with a relieving arch, or a pipe sleeve shall be built into the foundation wall. The sleeve shall be two pipe sizes greater than the pipe passing through the wall.

1.5.6 **Freezing**. Water, soil and waste pipes shall not be installed outside of a building, in attics or crawl spaces, concealed in outside walls, or in any other place subjected to freezing temperature unless adequate provision is made to protect such pipes from freezing by insulation or heat or both. Exterior water supply system piping shall be installed not less than 150 mm below the frost line and not less than 300 mm below grade.

1.5.6.1 **Sewer depth**. Building sewers that connect to private sewage disposal systems shall be a minimum of 500 mm below finished grade at the point of septic tank or cesspool connection. Building sewers shall be a minimum of 300 mm below grade.

1.5.7 **Waterproofing of openings**. Joints at the roof and around vent pipes, shall be made water tight by the use of lead, copper, galvanized steel, aluminum, plastic or other approved flashings or flashing material. Exterior wall openings shall be made water tight.

1.5.8 **Protection against physical damage**. In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 40 mm from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1.5 mm thick steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 50 mm above sole plates and below top plates.

1.5.9 **Protection of components of plumbing system**. Components of a plumbing system installed along alleyways, driveways, parking garages or other locations exposed to damage shall be recessed into the wall or otherwise protected in an approved manner.

SECTION 1.6
TRENCHING, EXCAVATION AND BACKFILL

1.6.1 **Support of piping**. Buried piping shall be supported throughout its entire length.

1.6.2 **Trenching and bedding**. Where trenches are excavated such that the bottom of the trench forms the bed for the pipe, solid and continuous load-bearing support shall be provided between joints. Bell holes, hub holes and coupling holes shall be provided at points where the pipe is joined. Such pipe shall not be supported on blocks to grade. In instances where the materials manufacturer's installation instructions are more restrictive than those prescribed by these requirements SBC 701 the material shall be installed in accordance with the more restrictive requirement.

1.6.2.1 **Over-excavation**. Where trenches are excavated below the installation level of the pipe such that the bottom of the trench does not form the bed for the pipe, the trench shall be backfilled to the installation level of the bottom of the pipe with sand or fine gravel placed in layers of 150 mm maximum depth and such backfill shall be compacted after each placement.

1.6.2.2 **Rock removal.** Where rock is encountered in trenching, the rock shall be removed to a minimum of 75 mm below the installation level of the bottom of the pipe, and the trench shall be backfilled to the installation level of the bottom of the pipe with sand tamped in place so as to provide uniform load-bearing support for the pipe between joints. The pipe, including the joints, shall not rest on rock at any point.

1.6.2.3 **Soft load-bearing materials**. If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by over-excavating a minimum of two pipe diameters and backfilling to the installation level of the bottom of the pipe with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

1.6.3 **Backfilling**. Backfill shall be free from discarded construction material and debris. Loose earth free from rocks, broken concrete and frozen chunks shall be placed in the trench in 150 mm layers and tamped in place until the crown of the pipe is covered by 300 mm of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by these requirements SBC 701, the material shall be installed in accordance with the more restrictive requirements.

1.6.4 **Tunneling**. Where pipe is to be installed by tunneling, jacking or a combination of both, the pipe shall be protected from damage during installation and from subsequent uneven loading. Where earth tunnels are used, adequate supporting structures shall be provided to prevent future settling or caving.

SECTION 1.7
STRUCTURAL SAFETY

1.7.1 **General**. In the process of installing or repairing any part of a plumbing and drainage installation, the finished floors, walls, ceilings, tile work or any other part of the building or premises that must be changed or replaced shall be left in a safe structural condition in accordance with the requirements of the Saudi Building Code Architectural Requirements SBC 201, and the Saudi Building Code SBC 301 and SBC 306.

1.7.2 **Cutting, notching or bored holes. A** framing member shall not be cut, notched or bored in excess of limitations specified in the Saudi Building Code Architectural Requirements SBC 201, and the Saudi Building Code Structural Requirements SBC 301 and SBC 306.

1.7.3 **Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies**. Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resistance rating shall be protected in accordance with the Saudi Building Code Architectural Requirements SBC 201, the Saudi Building Code Structural Requirements SBC 301, SBC 306 and the Saudi Building Code Fire Protection Requirements SBC 801.

1.7.4 **Alterations to trusses.** Truss members and components shall not be cut, drilled, notched, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (e.g., HVAC equipment, water heater) shall not be permitted without verification that the truss is capable of supporting such additional loading.

1.7.5 **Trench location**. Trenches installed parallel to footings shall not extend below the 45-degree bearing plane of the footing or wall.

1.7.6 **Piping materials exposed within plenums**. All piping materials exposed within plenums shall comply with the provisions of the Saudi Building Code Mechanical Requirements SBC 501.

SECTION 1.8
PIPING SUPPORT

1.8.1 **General**. All plumbing piping shall be supported in accordance with this section.

1.8.2 **Piping seismic supports**. Where earthquake loads are applicable in accordance with the Saudi Building Code Structural Requirements – Loading and Forces SBC 301, plumbing piping supports shall be designed and installed for the seismic forces in accordance with the Saudi Building Code Structural Requirements – Loading and Forces SBC 301.

1.8.3 **Materials**. Hangers, anchors and supports shall support the piping and the contents of the piping. Hangers and strapping material shall be of approved material that will not promote galvanic action.

1.8.4 **Structural attachment**. Hangers and anchors shall be attached to the building construction in an approved manner.

1.8.5 **Interval of support**. Pipe shall be supported in accordance with Table 1.8.5.
Exception: The interval of support for piping systems designed to provide for expansion/contraction shall conform to the engineered design in accordance with Saudi Building Code Regulations.

TABLE 1.8.5
HANGER SPACING

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (m)	MAXIMUM VERTICAL SPACING (m)
ABS pipe	1.2	3.0[b]
Aluminum tubing	3.0	4.5
Brass pipe	3.0	3.0
Cast-iron pipe	1.5[a]	4.5
Copper or copper-alloy pipe	3.6	3.0
Copper or copper-allow tubing, 32 mm diameter and smaller	1.8	3.0
Copper or copper-alloy tubing, 40 mm diameter and larger	3.0	3.0
Cross-linked polyethylene (PEX) pipe	0.8	3.0[b]
Cross-linked polyethylene/Aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	0.8	1.2[b]
CPVC pipe or tubing, 25 mm or smaller	0.9	3.0[b]
CPVC pipe or tubing, 32 mm or larger	1.2	3.0[b]
Steel pipe	3.6	4.5
Lead pipe	Continuous	1.2
PB pipe or tubing	0.8	1.2
Polyethylene/aluminum/polyethylene (PE-AL-PE) pipe	0.8	1.2[b]
PVC pipe	1.2	3.0[b]
Stainless steel drainage systems	3.0	3.0[b]

a) The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 3.0 m where 3.0 m lengths of pipe are installed.
b) Midstory guide for sizes 50 mm and smaller.

1.8.6 **Sway bracing**. Rigid support sway bracing shall be provided at changes in direction greater than 45 degrees for pipe sizes 100 mm and larger.

1.8.7 **Anchorage**. Anchorage shall be provided to restrain drainage piping from axial movement.

1.8.7.1 **Location**. For pipe sizes greater than 100 mm, restraints shall be provided for drain pipes at all changes in direction and at all changes in diameter greater than two pipe sizes. Braces, blocks, rodding and other suitable methods as specified by the coupling manufacturer shall be utilized.

1.8.8 **Expansion joint fittings.** Expansion joint fittings shall be used only where necessary to provide for expansion and contraction of the pipes. Expansion joint fittings shall be of the typical material suitable for use with the type of piping in which such fittings are installed.

1.8.9 **Stacks**. Bases of stacks shall be supported by concrete, brick laid in cement mortar or metal brackets attached to the building or by other approved methods.

1.8.10 **Parallel water distribution systems**. Piping bundles for manifold systems shall be supported in accordance with Table 1.8.5. Support at changes in direction shall be in accordance with the manufacturer's installation instructions. Hot and cold water piping shall not be grouped in the same bundle.

SECTION 1.9
FLOOD HAZARD RESISTANCE

1.9.1 **General.** Plumbing systems and equipment in structures erected in flood hazard areas shall be constructed in accordance with the requirements of this section and the Saudi Building Code Architectural Requirements SBC 201 and the Saudi Building Code Structural Requirements – Loading and Forces SBC 301 and the Saudi Building Code Structural Requirements – Soil and Foundations SBC 303.

1.9.2 **Flood hazard.** For structures located in flood hazard areas, the following systems and equipment shall be located at or above the design flood elevation:

1. All water service pipes.
2. Pump seals in individual water supply systems where the pump is located below the design flood elevation.
3. Covers on potable water wells shall be sealed, except where the top of the casing well or pipe sleeve is elevated to at least 300 mm above the design flood elevation.
4. All sanitary drainage piping.
5. All storm drainage piping.
6. Manhole covers shall be sealed, except where elevated to or above the design flood elevation.
7. All other plumbing fixtures, faucets, fixture fittings, piping systems and equipment.
8. Water heaters.
9. Vents and vent systems.

Exception: The following systems are permitted to be located below the design flood elevation provided that the systems are designed and installed to prevent water from entering or accumulating within their components and the systems are constructed to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation.

1.9.3 **Flood hazard areas subject to high-velocity wave action**. Structures located in flood hazard areas subject to high-velocity wave action shall meet the requirements of Section 1.9.2. The plumbing systems, pipes and fixtures shall not be mounted on or penetrate through walls intended to break away under flood loads.

SECTION 1.10
WASHROOM AND TOILET ROOM REQUIREMENTS

1.10.1 **Light and ventilation.** Washrooms and toilet rooms shall be illuminated and ventilated in accordance with the Saudi Building Code Architectural Requirements SBC 201 and the Saudi Building Code Mechanical Requirements SBC 501.

1.10.2 **Location of fixtures and piping.** Piping, fixtures or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors or other means of egress openings.

1.10.3 **Interior finish.** Interior finish surfaces of toilet rooms shall comply with the Saudi Building Code Architectural Requirements SBC 201.

1.10.4 **Water closet compartment.** Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in day care and child-care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.

SECTION 1.11
TOILET FACILITIES FOR WORKERS

1.11.1 **General.** Toilet facilities shall be provided for construction workers and such facilities shall be maintained in a sanitary condition. Construction worker toilet facilities of the non-sewer type shall conform to ANSI Z4.3.

SECTION 1.12
TESTS AND INSPECTIONS

1.12.1 **Required tests.** The permit holder shall make the applicable tests prescribed in Sections 1.12.2 through 1.12.9 to determine compliance with the provisions of these requirements SBC 701. The permit holder shall give reasonable advance notice to the code official when the plumbing work is ready for tests. The equipment, material, power and labor necessary for the inspection and test shall be furnished by the permit holder and the permit holder shall be responsible for determining that the work will withstand the test pressure prescribed in the following tests. All plumbing system piping shall be tested with either water or, for piping systems other than plastic, by air. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted

to final tests. The code official shall require the removal of any cleanouts if necessary to ascertain whether the pressure has reached all parts of the system.

1.12.1.1 **Test gauges**. Gauges used for testing shall be as follows:

1. Tests requiring a pressure of 70 kPa or less shall utilize a testing gauge having increments of 0.5 kPa or less.
2. Tests requiring a pressure of greater than 70 kPa but less than or equal to 700 kPa shall utilize a testing gauge having increments of 5 kPa or less.
3. Tests requiring a pressure of greater than 700 kPa shall utilize a testing gauge having increments of 15 kPa or less.

1.12.2 **Drainage and vent water test.** A water test shall be applied to the drainage system either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 3 m head of water. In testing successive sections, at least the upper 3 m of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 3 m of the system, shall have been submitted to a test of less than a 3 m head of water. This pressure shall be held for at least 15 minutes. The system shall then be tight at all points.

1.12.3 **Drainage and vent air test.** An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 35 kPa or sufficient to balance a 250 mm column of mercury. This pressure shall be held for a test period of at least 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period.

1.12.4 **Drainage and vent final test**. The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of these requirements SBC 701 except that the plumbing shall be subjected to a smoke test where necessary for cause. Where the smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 250 Pa shall be held for a test period of not less than 15 minutes.

1.12.5 **Water supply system test**. Upon completion of a section of or the entire water supply system, the system, or portion completed, shall be tested and proved tight under a water pressure not less than the working pressure of the system; or, for piping systems other than plastic, by an air test of not less than 350 kPa. The water utilized for tests shall be obtained from a potable source of supply. The required tests shall be performed in accordance with this section and the Saudi Building Code Regulations.

1.12.6 **Gravity sewer test**. Gravity sewer tests shall consist of plugging the end of the building sewer at the point of connection with the public sewer, filling the building sewer with water, testing with not less than a 3 m head of water and maintaining such pressure for 15 minutes.

1.12.7 **Forced sewer test**. Forced sewer tests shall consist of plugging the end of the building sewer at the point of connection with the public sewer and applying a pressure of 35 kPa greater than the pump rating, and maintaining such pressure for 15 minutes.

1.12.8 **Storm drainage system test.** Storm drain systems within a building shall be tested by water or air in accordance with Section 1.12.2 or 1.12.3.

1.12.9 **Inspection and testing of backflow prevention assemblies**. Inspection and testing shall comply with Sections 1.12.9.1 and 1.12.9.2.

1.12.9.1 **Inspections.** Annual inspections shall be made of all backflow prevention assemblies and air gaps to determine whether they are operable.

1.12.9.2 **Testing.** Reduced pressure principle backflow preventer assemblies, double check-valve assemblies, pressure vacuum breaker assemblies, reduced pressure detector fire protection backflow prevention assemblies, double check detector fire protection backflow prevention assemblies, hose connection backflow preventers, and spill-proof vacuum breakers shall be tested at the time of installation, immediately after repairs or relocation and at least annually. The testing procedure shall be performed in accordance with one of the following standards:
ASSE 5013, ASSE 5015, ASSE 5020, ASSE 5047, ASSE 5048, ASSE 5052, ASSE 5056, CAN/CSA B64.l0.

SECTION 1.13
EQUIPMENT EFFICIENCIES

1.13.1 **General.** Equipment efficiencies shall be in accordance with the Saudi Building Code Energy Conservation Requirements SBC 601.

SECTION 1.14
CONDENSATE DISPOSAL

1.14.1 **Fuel-burning appliances.** Liquid combustion byproducts of condensing appliances shall be collected and discharged to an approved plumbing fixture or disposal area in accordance with the manufacturer's installation instructions. Condensate piping shall be of approved corrosion-resistant material and shall not be smaller than the drain connection on the appliance. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1-percent slope.

1.14.2 **Evaporators and cooling coils.** Condensate drain systems shall be provided for equipment and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 1.14.2.1 through 1.14.2.3.

1.14.2.1 **Condensate disposal**. Condensate from all cooling coils and evaporators shall be conveyed from the drain pan outlet to an approved place of disposal. Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.

1.14.2.2 **Drain pipe materials and sizes**. Components of the condensate disposal system shall be cast iron, galvanized steel, copper, cross-linked polyethylene, polybutylene, polyethylene, ABS, CPVC, or PVC pipe or tubing. All components shall be selected for the pressure and temperature rating of the installation.

Condensate waste and drain line size shall not be less than 20 mm internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an approved method. All horizontal sections of drain piping shall be installed in uniform alignment at a uniform slope.

1.14.2.3 **Auxiliary and secondary drain systems**. In addition to the requirements of Section 1.14.2.1, a secondary drain or auxiliary drain pan shall be required for each cooling or evaporator coil where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping. One of the following methods shall be used:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 40 mm, shall not be less than 75 mm larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Metallic pans shall have a minimum thickness of not less than 0.75 mm galvanized sheet metal. Nonmetallic pans shall have a minimum thickness of not less than 1.5 mm.

2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.

3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water level detection device that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.

1.14.2.4 **Traps**. Condensate drains shall be trapped as required by the equipment or appliance manufacturer.

CHAPTER 2
FIXTURES, FAUCETS AND FIXTURE FITTINGS

SECTION 2.1
GENERAL

2.1.1 **Scope**. This chapter shall govern the materials, design and installation of plumbing fixtures, faucets and fixture fittings in accordance with the type of occupancy, and shall provide for the minimum number of fixtures for various types of occupancies.

2.1.2 **Prohibited fixtures and connections**. Water closets having a concealed trap seal or an unventilated space or having walls that are not thoroughly washed at each discharge in accordance with SASO 1258/1998 and SASO 1473/1999 shall be prohibited. Any water closet that permits siphonage of the contents of the bowl back into the tank shall be prohibited. Trough urinals shall be prohibited.

2.1.3 **Water conservation**. The maximum water flow rates and flush volume for plumbing fixtures and fixture fittings shall comply with Section 3.4.4.

SECTION 2.2
FIXTURE MATERIALS

2.2.1 **Quality of fixtures**. Plumbing fixtures shall be constructed of approved materials, with smooth, impervious surfaces, free from defects and concealed fouling surfaces, and shall conform to standards cited in these requirements SBC 701. All porcelain enameled surfaces on plumbing fixtures shall be acid resistant.

2.2.2 **Materials for specialty fixtures**. Materials for specialty fixtures not otherwise covered in these requirements SBC 701 shall be of stainless steel, soapstone, chemical stoneware or plastic, or shall be lined with lead, copper-base alloy, nickel-copper alloy, corrosion-resistant steel or other material especially suited to the application for which the fixture is intended, and shall conform to approved standards.

2.2.3 **Sheet copper**. Sheet copper for general applications shall conform to ASTM B152 and shall not weigh less than 3.5 kg/m^2.

2.2.4 **Sheet lead**. Sheet lead for pans shall not weigh less than 19.5 kg/m^2 coated with an asphalt paint or other approved coating.

SECTION 2.3
MINIMUM PLUMBING FACILITIES

2.3.1 **Minimum number of fixtures**. Plumbing fixtures shall be provided for the type of occupancy and in the minimum number shown in Table 2.3.1. Types of occupancies not shown in Table 2.3.1 shall be considered individually by the code official. The number of occupants shall be determined by the Saudi Building Code Architectural Requirements SBC 201. Occupancy classification shall be determined in accordance with the Saudi Building Code Architectural Requirements SBC 201.

TABLE 2.3.1
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES
(See Sections 2.3.2 and 2.3.3)

No	Classification	Use Group	Description	Water Closets (Urinals see Section 2.19.2)		Lavatories (Wash basin)		Bathtubs/ Showers	Drinking Fountain (See Section 2.10.1)	Other
				Male	Female	Male	Female			
1	Assembly (see Sections 2.3.2, 2.3.5 and 2.3.6)	A-1	Theaters usually with fixed seats and other buildings for the performing arts and motion pictures	1 per 125	1 per 65	1 per 200		—	1 per 500	1 service sink
		A-2	Wedding halls and buildings for similar purposes	1 per 40	1 per 40	1 per 20		—	1 per 500	1 service sink
			Restaurants, banquet halls and food courts	1 per 75	1 per 75	1 per 200		—	1 per 500	1 service sink
		A-3	Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums	1 per 125	1 per 65	1 per 200		—	1 per 500	1 service sink
			Passenger terminals and transportation facilities	1 per 500	1 per 500	1 per 750		—	1 per 1,000	1 service sink
			Masajed	1 per 100	1 per 50	1 per 25 (Including wadu taps)		1 per 200	1 per 500	1 service sink
		A-4	Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for remainder exceeding 1,500	1 per 40 for the first 1,500 and 1 per 60 for the remainder exceeding 1,500	1 Per 200	1 per 150	—	1 per 1,000	1 service sink

No	Classification	Use Group	Description	Water Closets (Urinals see Section 2.19.2)		Lavatories (Wash basin)		Bathtubs/ Showers	Drinking Fountain (See Section 2.10.1)	Other
				Male	Female	Male	Female			
		A-5	Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,500 and 1 per 60 for the remainder exceeding 1,500	1 per 200	1 per 150	—	1 per 1,000	1 service sink
2	Business (see Sections 2.3.2, 2.3.4 and 2.3.6)	B	Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial and similar uses	1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50		1 per 40 for the first 50 and 1 per 80 for the remainder exceeding 50		—	1 per 100	1 service sink
3	Educational	E	Educational Facilities	1 per 50		1 per 50		—	1 per 100	1 service sink
4	Factory and industrial	F-1 and F-2	Structures in which occupants are engaged in work fabricating, assembly or processing of products or materials	1 per 15		1 per 15		(see Section 2.11)	1 per 60	1 service sink
5	Institutional	I-1	Residential care	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		I-2	Hospitals, ambulatory nursing home patients [b]	1 per room [c]		1 per room [c]		1 per 15	1 per 100	1 service sink per floor
			Employees, other than residential care [b]	1 per 25		1 per 35		—	1 per 100	—

No	Classification	Use Group	Description	Water Closets (Urinals see Section 2.19.2)		Lavatories (Wash basin)		Bathtubs/ Showers	Drinking Fountain (See Section 2.10.1)	Other
				Male	Female	Male	Female			
			Visitors, other than residential care	1 per 75		1 per 100		—	1 per 500	—
		I-3	Prisons [b]	1 per cell		1 per cell		1 per 15	1 per 100	1 service sink
			Reformitories, detention centers, and correctional centers [b]	1 per 15		1 per 15		1 per 15	1 per 100	1 service sink
		I-4	Adult daycare and childcare [b]	1 per 15		1 per 15		1 per 15[d]	1 per 100	1 service sink
6	Mercantile (see Sections 2.3.2, 2.3.5 and 2.3.6)	M	Retail stores, service stations, shops, salesrooms, markets and shopping centers	1 per 500		1 per 750		—	1 per 1,000	1 service sink
7	Residential	R-1	Hotels, motels, boarding houses (transient)	1 per guestroom		1 per guestroom		1 per guestroom	—	1 service sink
		R-2	Dormitories, fraternities, sororities and boarding houses (not transient)	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		R-2	Apartment house	1 per dwelling unit		1 per dwelling unit		1 per dwelling unit	—	1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units[e]

No	Classification	Use Group	Description	Water Closets (Urinals see Section 2.19.2)		Lavatories (Wash basin)		Bathtubs/ Showers	Drinking Fountain (See Section 2.10.1)	Other
				Male	Female	Male	Female			
		R-3	One- and two family dwellings	1 per dwelling unit		1 per dwelling unit		1 per dwelling unit	—	1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit [e]
		R-4	Residential care/assisted living facilities	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
8	Storage (see Sections 2.3.2 and 2.3.4)	S-1 S-2	Structures for the storage of goods, warehouses, storehouse and freight depots. Low and Moderate Hazard.	1 per 100		1 per 100		1 per 1,000	See Section 2.11	1 service sink

a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by the Saudi Building Code Architectural Requirements SBC 201.
b. Toilet facilities for employees shall be separate from facilities for inmates or patients.
c. A single-occupant toilet room with one water closet and one lavatory (wash basin) serving not more than two adjacent patient rooms shall be permitted where such room is provided with direct access from each patient room and with provisions for privacy.
d. For day nurseries, a maximum of one bathtub shall be required.
e. For attached one- and two-family dwellings, one automatic clothes washer connection shall be required per 20 dwelling units.

2.3.2 **Separate facilities**. Where plumbing fixtures are required, separate facilities shall be provided for each sex.
Exceptions: Separate facilities shall not be required for private facilities.

2.3.3 **Number of occupants of each sex**. The required water closets, lavatories (wash basin), and showers or bathtubs shall be distributed equally between the sexes based on the percentage of each sex anticipated in the occupant load. The occupant load shall be composed of 50 percent of each sex, unless statistical data approved by the code official indicate a different distribution of the sexes.

2.3.4 **Location of employee toilet facilities in occupancies other than assembly or mercantile**. Access to toilet facilities in occupancies other than mercantile and assembly occupancies shall be from within the employees' working area. Employee facilities shall be either separate facilities or combined employee and public facilities.
Exception: Facilities that are required for employees in storage structures or kiosks, and are located in adjacent structures under the same ownership, lease or control, shall be a maximum travel distance of 150 m from the employees' working area.

2.3.4.1 **Travel distance.** The required toilet facilities in occupancies other than assembly or mercantile shall be located not more than one story above or below the employee's working area and the path of travel to such facilities shall not exceed a distance of 150 m.
Exception: The location and maximum travel distances to require employee toilet facilities in factory and industrial occupancies are permitted to exceed that required in Section 2.3.4.1, provided the location and maximum travel distance are approved by the code official.

2.3.5 **Location of employee toilet facilities in mercantile and assembly occupancies**. Employees shall be provided with toilet facilities in building and tenant spaces utilized as restaurants, places of public assembly and mercantile occupancies. The employee facilities shall be either separate facilities or combined employee and public facilities. The required toilet facilities shall be located not more than one story above or below the employees' work area and the path of travel to such facilities, in other than covered malls, shall not exceed a distance of 150 m. The path of travel to required facilities in covered malls shall not exceed a distance of 90 m.
Exception: Employee toilet facilities shall not be required in tenant spaces where the travel distance from the main entrance of the tenant space to a central toilet area does not exceed 90 m and such central toilet facilities are located not more than one story above or below the tenant space.

2.3.6 **Public facilities**. Customers, patrons and visitors shall be provided with public toilet facilities in structures and tenant spaces intended for public utilization. Public toilet facilities shall be located not more than one story above or below the space required to be provided with public toilet facilities and the path of travel to such facilities shall not exceed a distance of 150 m.

2.3.6.1 **Covered malls**. In covered mall buildings, the path of travel to require toilet facilities shall not exceed a distance of 90 m. Facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum travel distance to the central toilet facilities in covered mall buildings shall be measured from the main entrance of any store or tenant space.

2.3.6.2 **Pay facilities** Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

2.3.7 **Signage**. Required public facilities shall be designated by a legible sign for each sex. Signs shall be readily visible and located near the entrance to each toilet facility.

SECTION 2.4
ACCESSIBLE PLUMBING FACILITIES

2.4.1 **Where required**. Accessible plumbing facilities and fixtures shall be provided in accordance with the Saudi Building Code Architectural Requirements SBC 201.

SECTION 2.5
INSTALLATION OF FIXTURES

2.5.1 **Water supply protection**. The supply lines and fittings for every plumbing fixture shall be installed so as to prevent backflow.

2.5.2 **Access for cleaning**. Plumbing fixtures shall be installed so as to afford easy access for cleaning both the fixture and the area around the fixture.

2.5.3 **Setting**. Fixtures shall be set level and in proper alignment with reference to adjacent walls.

2.5.3.1 **Water closets, urinals, lavatories (wash basin) and bidets**. A water closet, urinal, lavatory (wash basin) or bidet shall not be set closer than 0.4 m from its center to any side wall, partition, vanity or other obstruction, or closer than 0.75 m center-to-center between water closets, urinals or adjacent fixtures. There shall be at least a 0.5 m clearance in front of the water closet, urinal or bidet to any wall, fixture or door. Water closet compartments shall not be less than 0.8 m wide or 1.5 m deep. There shall be at least a 0.5 m clearance in front of a lavatory (wash basin) to any wall, fixture or door (see Figure 2.5.3.1).

2.5.3.2 **Public lavatories (wash basins).** In employee and public toilet rooms, the required lavatory (wash basin) shall be located in the same room as the required water closet.

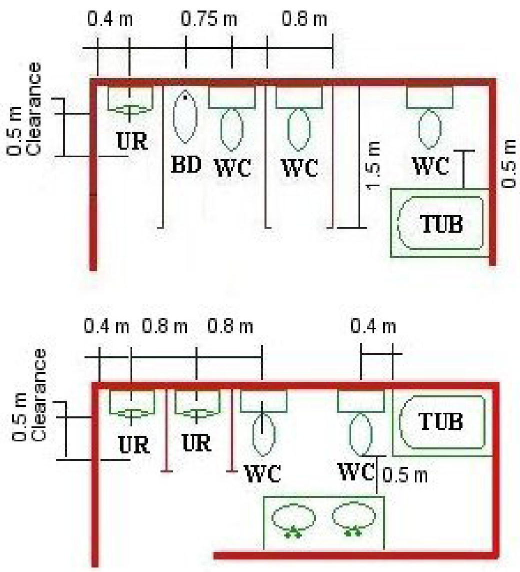


FIGURE 2.5.3.1
FIXTURE CLEARANCE

2.5.4 **Floor and wall drainage connections**. Connections between the drain and floor outlet plumbing fixtures shall be made with a suitable means. Connections between the drain and wall-hung water closets shall be made with an approved extension nipple or horn adapter. The water closet shall be bolted to the hanger with corrosion-resistant bolts or screws. Joints shall be sealed with an elastomeric gasket.

2.5.4.1 **Securing floor outlet fixtures**. Floor outlet fixtures shall be secured to the floor by screws or bolts of corrosion-resistant material.

2.5.4.2 **Securing wall-hung water closet bowls**. Wall-hung water closet bowls shall be supported by a concealed metal carrier that is attached to the building structural members so that strain is not transmitted to the closet connector or any other part of the plumbing system. The carrier shall conform to ASME Al12.6.1M, ASME Al12.6.2.

2.5.5 **Water-tight joints**. Joints formed where fixtures come in contact with walls or floors shall be sealed.

2.5.6 **Plumbing in mental health centers**. In mental health centers, pipes or traps shall not be exposed, and fixtures shall be bolted through walls.

2.5.7 **Design of overflows**. Where any fixture is provided with an overflow, the waste shall be designed and installed so that standing water in the fixture will not rise in the overflow when the stopper is closed, and no water will remain in the overflow when the fixture is empty.

2.5.7.1 **Connection of overflows**. The overflow from any fixture shall discharge into the drainage system on the inlet or fixture side of the trap.

Exception: The overflow from a flush tank serving a water closet or urinal shall discharge into the fixture served.

2.5.8 **Slip joint connections**. Slip joints shall be made with an approved elastomeric gasket and shall only be installed on the trap outlet, trap inlet and within the trap seal. Fixtures with concealed slip-joint connections shall be provided with an access panel or utility space at least 300 mm in its smallest dimension or other approved arrangement so as to provide access to the slip joint connections for inspection and repair.

2.5.9 **Design and installation of plumbing fixtures**. Integral fixture fitting mounting surfaces on manufactured plumbing fixtures or plumbing fixtures constructed on site, shall meet the design requirements of ASME A112.19.2M, ASME A112.19.3M.

SECTION 2.6
AUTOMATIC CLOTHES WASHERS

2.6.1 **Approval**. Domestic automatic clothes washers shall conform to SASO 141/1979.

2.6.2 **Water connection**. The water supply to an automatic clothes washer shall be protected against backflow by an air gap installed integrally within the machine conforming to SASO 141/1979 or with the installation of a backflow preventer in accordance with Section 3.8.

2.6.3 **Waste connection**. The waste from an automatic clothes washer shall discharge through an air break into a standpipe in accordance with Section 4.16.4 or into a

laundry sink. The trap and fixture drain for an automatic clothes washer standpipe shall be a minimum of 50 mm in diameter. The automatic clothes washer fixture drain shall connect to a branch drain or drainage stack a minimum of 75 mm in diameter.

SECTION 2.7
BATHTUBS

2.7.1 **Approval**. Bathtubs shall conform to ANSI Z124.l, ASME A112.19.1M, ASME A112.19.4M, ASME A112.19.9M, CSA B45.2, CSA B45.3, CSA B45.5 or approved equivalent standards.

2.7.2 **Bathtub waste outlets**. Bathtubs shall have waste outlets a minimum of 40 mm in diameter. The waste outlet shall be equipped with an approved stopper.

2.7.3 **Glazing**. Windows and doors within a bathtub enclosure shall conform to the safety glazing requirements of the Saudi Building Code Architectural Requirements SBC 201.

2.7.4 **Bathtub enclosure**. Doors within a bathtub enclosure shall conform to ASME A112.19.l5.

SECTION 2.8
BIDETS

2.8.1 **Approval**. Bidets shall conform to SASO 1475/1999.

2.8.2 **Water connection**. The water supply to a bidet shall be protected against backflow by an air gap or backflow preventer in accordance with Section 3.8.13.1, 3.8.13.2, 3.8.13.3, 3.8.13.5, 3.8.13.6 or 3.8.13.8.

SECTION 2.9
DISHWASHING MACHINES

2.9.1 **Approval**. Domestic dishwashing machines shall conform to SASO 1447/1998. Commercial dishwashing machines shall conform to ASSE 1004, NSF 3.

2.9.2 **Water connection**. The water supply to a dishwashing machine shall be protected against backflow by an air gap or backflow preventer in accordance with Section 3.8.

2.9.3 **Waste connection**. The waste connection of a dishwashing machine shall comply with Section 4.16.1.6 or 4.16.1.7, as applicable.

SECTION 2.10
DRINKING FOUNTAINS AND WATER COOLERS

2.10.1 **Approval**. Drinking fountains and water coolers shall conform to SASO 415/1985 and NSF 61, Section 9 or approved equivalent standards. Where water is served in restaurants, drinking fountains shall not be required. In other occupancies, where drinking fountains are required, bottled water dispensers shall be permitted to be substituted for not more than 50 percent of the required drinking fountains.

2.10.2 **Prohibited location**. Drinking fountains shall not be installed in public restrooms.

SECTION 2.11
EMERGENCY SHOWERS AND EYEWASH STATIONS

2.11.1 **Approval**. Emergency showers and eyewash stations shall conform to ISEA Z358.l.

2.11.2 **Waste connection**. Waste connections shall not be required for emergency showers and eyewash stations.

SECTION 2.12
FLOOR AND TRENCH DRAINS

2.12.1 **Approval**. Floor drains shall conform to ASME A112.6.3, ASME A112.3.l, CSA B79. Trench drains shall comply with ASME Al12.6.3.

2.12.2 **Floor drain trap and strainer**. Floor drain traps shall have removable strainers. The strainer shall have a waterway area of not less than the area of the tailpiece. The floor drain shall be constructed so that the drain is capable of being cleaned. Access shall be provided to the drain inlet.

2.12.3 **Size of floor drains**. Floor drains shall have a minimum 50 mm drain outlet.

2.12.4 **Public laundries and central washing facilities**. In public coin-operated laundries and in the central washing facilities of multiple-family dwellings, the rooms containing automatic clothes washers shall be provided with floor drains located to readily drain the entire floor area. Such drains shall have a minimum outlet of not less than 75 mm in diameter.

SECTION 2.13
FOOD WASTE GRINDER UNITS

2.13.1 **Approval**. Domestic food waste grinders shall conform to ASSE 1008. Commercial food waste grinders shall conform to ASSE 1009. Food waste grinders shall not increase the drainage fixture unit load on the sanitary drainage system.

2.13.2 **Domestic food waste grinder waste outlets**. Domestic food waste grinders shall be connected to a drain of not less than 40 mm in diameter.

2.13.3 **Commercial food waste grinder waste outlets**. Commercial food waste grinders shall be connected to a drain a minimum of 50 mm in diameter. Commercial food waste grinders shall be connected and trapped separately from any other fixtures or sink compartments.

2.13.4 **Water supply required.** All food waste grinders shall be provided with a supply of cold water.

SECTION 2.14
GARBAGE CAN WASHERS

2.14.1 **Water connection**. The water supply to a garbage can washer shall be protected against backflow by an air gap or a backflow preventer in accordance with Section

3.8.13.1, 3.8.13.2, 3.8.13.3, 3.8.13.5, 3.8.13.6 or 3.8.13.8.

2.14.2 **Waste connection**. Garbage can washers shall be trapped separately. The receptacle receiving the waste from the washer shall have a removable basket or strainer to prevent the discharge of large particles into the drainage system.

SECTION 2.15
LAUNDRY TRAYS

2.15.1 **Approval**. Laundry trays shall conform to ANSIZ124.6, ASME A112.19.lM, ASME A112.19.3M, ASME A112.19.9M, CSA B45.2 and CSA B45.4.

2.15.2 **Waste outlet**. Each compartment of a laundry tray shall be provided with a waste outlet a minimum of 40 mm in diameter and a strainer or crossbar to restrict the clear opening of the waste outlet.

SECTION 2.16
LAVATORIES (WASH BASINS)

2.16.1 **Approval**. Lavatories (wash basins) shall conform to SASO 1476/1999. Group wash-up equipment shall conform to the requirements of Section 2.2. Every 500 mm of rim space shall be considered as one lavatory (wash basin).

2.16.2 **Cultured marble lavatories (wash basins).** Cultured marble vanity tops with an integral lavatory (wash basin) shall conform to ANSI Zl24.3 and CSA B45.5.

2.16.3 **Lavatory (wash basin) waste outlets**. Lavatories (wash basins) shall have waste outlets not less than 32 mm in diameter. A strainer, pop-up stopper, crossbar or other device shall be provided to restrict the clear opening of the waste outlet.

2.16.4 **Moveable lavatory (wash basin) systems**. Moveable lavatory (wash basin) systems shall comply with ASME Al12.19.12.

SECTION 2.17
SHOWERS

2.17.1 **Approval**. Prefabricated showers and shower compartments shall conform to ANSI Z124.2, ASME A112.19.9M and CSA B45.5. Shower valves for individual showers shall conform to the requirements of Section 2.24.4.

2.17.2 **Water supply riser**. Every water supply riser from the shower valve to the shower head outlet, whether exposed or not, shall be attached to the structure in an approved manner.

2.17.3 **Shower waste outlet**. Waste outlets serving showers shall be at least 40 mm in diameter and, for other than waste outlets in bathtubs, shall have removable strainers not less than 75 mm in diameter with strainer openings not less than 6 mm in minimum dimension. Where each shower space is not provided with an individual waste outlet, the waste outlet shall be located and the floor pitched so that waste from one shower does not flow over the floor area serving another shower. Waste outlets shall be fastened to the waste pipe in an approved manner.

2.17.4 **Shower compartments**. All shower compartments shall have a minimum of 0.6 $m^2$of interior cross-sectional area. Shower compartments shall not be less than 0.75 m in minimum dimension measured from the finished interior dimension of the compartment, exclusive of fixture valves, showerheads, soap dishes, and safety grab bars or rails. Except as required in Section 2.4, the minimum required area and dimension shall be measured from the finished interior dimension at a height equal to the top of the threshold and at a point tangent to its centerline and shall be continued to a height not less than 1.8 m above the shower drain outlet.

2.17.4.1 **Wall area**. The wall area above built-in tubs with installed shower heads and in shower compartments shall be constructed of smooth, non corrosive and nonabsorbent waterproof materials to a height not less than 1.85 m above the room floor level, and not less than 1.8 m where measured from the compartment floor at the drain. Such walls shall form a water-tight joint with each other and with either the tub, receptor or shower floor.

2.17.5 **Shower floors or receptors**. Floor surfaces shall be constructed of impervious, noncorrosive, nonabsorbent and waterproof materials.

2.17.5.1 **Support**. Floors or receptors under shower compartments shall be laid on, and supported by, a smooth and structurally sound base.

2.17.5.2 **Shower lining**. Floors under shower compartments, except where prefabricated receptors have been provided, shall be lined and made water tight utilizing material complying with Sections 2.17.5.2.1 through 2.17.5.2.4. Such liners shall turn up on all sides at least 50 mm above the finished threshold level. Liners shall be recessed and fastened to an approved backing so as not to occupy the space required for wall covering, and shall not be nailed or perforated at any point less than 25 mm above the finished threshold. Liners shall be pitched 2-percent slope and shall be sloped toward the fixture drains and be securely fastened to the waste outlet at the seepage entrance, making a water-tight joint between the liner and the outlet.

Exception: Floor surfaces under shower heads provided for rinsing laid directly on the ground are not required to comply with this section.

2.17.5.2.1 **PVC sheets**. Plasticized polyvinyl chloride (PVC) sheets shall be a minimum of 1 mm thick, and shall meet the requirements of ASTM D 4551. Sheets shall be joined by solvent welding in accordance with the manufacturer's installation instructions.

2.17.5.2.2 **Chlorinated polyethylene (CPE) sheets**. Nonplasticized chlorinated polyethylene sheet shall be a minimum 1 mm thick, and shall meet the requirements of ASTM D 4068. The liner shall be joined in accordance with the manufacturer's installation instructions.

2.17.5.2.3 **Sheet lead**. Sheet lead shall not weigh less than 19.5 kg/m^2 coated with an asphalt paint or other approved coating. The lead sheet shall be insulated from conducting substances other than the connecting drain by 7 kg asphalt felt or its equivalent. Sheet lead shall be joined by burning.

2.17.5.2.4 **Sheet copper**. Sheet copper shall conform to ASTM B 152 and shall not weigh less than 3.5 kg/m^2. The copper sheet shall be insulated from conducting substances other than the connecting drain by 7 kg asphalt felt or its equivalent. Sheet copper shall be joined by brazing or soldering.

2.17.6 **Glazing**. Windows and doors within a shower enclosure shall conform to the safety glazing requirements of the Saudi Building Code Architectural Requirements SBC 201.

SECTION 2.18
SINKS

2.18.1 **Approval**. Sinks shall conform to ANSI Zl24.6, ASME A112.19.lM, ASME A112.19.2M, ASME A112.19.3M, ASME A112.19.4M, ASME A112.19.9M, CSA B45.l, CSA B45.2, CSA B4S.3 and CSA B45.4.

2.18.2 **Sink waste outlets**. Sinks shall be provided with waste outlets a minimum of 40 mm in diameter. A strainer or crossbar shall be provided to restrict the clear opening of the waste outlet.

2.18.3 **Moveable sink systems**. Moveable sink systems shall comply with ASME A112.19.12.

SECTION 2.19
URINALS

2.19.1 **Approval**. Urinals shall conform to ASME Al12.19.2M, CSA B45.1, CSA B45.5. Urinals shall conform to the water consumption requirements of Section 3.4.4. Urinals shall conform to the hydraulic performance requirements of ASME Al12.19.6, CSA B45.l and CSA B45.5.

2.19.2 **Substitution for water closets**. In each bathroom or toilet room, urinals shall not be substituted for more than 67 percent of the required water closets.

2.19.3 **Surrounding material**. Wall and floor space to a point 0.6 m in front of a urinal lip and 1.2 m above the floor and at least 0.6 m to each side of the urinal shall be waterproofed with a smooth, readily cleanable, nonabsorbent material.

SECTION 2.20
WATER CLOSETS

2.20.1 **Approval**. Water closets shall conform to the water consumption requirements of Section 3.4.4 and shall conform to SASO 1258/1998 and SASO 1473/1999. Water closets shall conform to the hydraulic performance requirements of SASO 1258/1998 and SASO 1473/1999. Water closet tanks shall conform to SASO 1257/1998. Electro-hydraulic water closets shall comply with ASME A112.19.13.

2.20.2 **Water closets for public or employee toilet facilities**. Water closet bowls for public or employee toilet facilities shall be of the elongated type.

2.20.3 **Water closet seats**. Water closets shall be equipped with seats of smooth, nonabsorbent material. All seats of water closets provided for public or employee toilet facilities shall be of the hinged open-front type. Integral water closet seats shall be of the same material as the fixture. Water closet seats shall be sized for the water closet bowl type.

SECTION 2.21
WHIRLPOOL BATHTUBS

2.21.1 **Approval**. Whirlpool bathtubs shall comply with ASME A112.19.7M or with CSA B45.5 and CSA B45 (Supplement 1).

2.21.2 **Installation**. Whirlpool bathtubs shall be installed and tested in accordance with the manufacturer's installation instructions. The pump shall be located above the weir of the fixture trap. Access shall be provided to the pump.

2.21.3 **Drain**. The pump drain and circulation piping shall be sloped to drain the water in the volute and the circulation piping when the whirlpool bathtub is empty.

2.21.4 **Suction fittings**. Suction fittings for whirlpool bathtubs shall comply with ASME A112.19.8M.

2.21.5 **Whirlpool enclosure**. Doors within a whirlpool enclosure shall conform to ASME A112.19.15.

SECTION 2.22
HEALTH CARE FIXTURES AND EQUIPMENT

2.22.1 **Scope**. This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to the requirements of this section in addition to these requirements SBC 701. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes, homes for the aged, orphanages, infirmaries, first aid stations, psychiatric facilities, clinics, professional offices of dentists and doctors, mortuaries, educational facilities, surgery, dentistry, research and testing laboratories, establishments manufacturing pharmaceutical drugs and medicines, and other structures with similar apparatus and equipment classified as plumbing.

2.22.2 **Approval**. All special plumbing fixtures, equipment, devices and apparatus shall be of an approved type.

2.22.3 **Protection**. All devices, appurtenances, appliances and apparatus intended to serve some special function, such as sterilization, distillation, processing, cooling, or storage of ice or foods, and that connect to either the water supply or drainage system, shall be provided with protection against backflow, flooding, fouling, contamination of the water supply system and stoppage of the drain.

2.22.4 **Materials**. Fixtures designed for therapy, special cleansing or disposal of waste materials, combinations of such purposes, or any other special purpose, shall be of smooth, impervious, corrosion-resistant materials and where subjected to temperatures in excess of $80^{o}C$, shall be capable of withstanding, without damage, higher temperatures.

2.22.5 **Access**. Access shall be provided to concealed piping in connection with special fixtures where such piping contains steam traps, valves, relief valves, check valves, vacuum breakers or other similar items that require periodic inspection, servicing, maintenance or repair. Access shall be provided to concealed piping that requires periodic inspection, maintenance or repair.

2.22.6 **Clinical sink**. A clinical sink shall have an integral trap in which the upper portion of a visible trap seal provides a water surface. The fixture shall be designed so as to permit complete removal of the contents by siphonic or blowout action and to reseal the trap. A flushing rim shall provide water to cleanse the interior surface. The fixture shall have the flushing and cleansing characteristics of a water closet.

2.22.7 **Prohibited usage of clinical sinks and service sinks**. A clinical sink serving a soiled utility room shall not be considered as a substitute for, or be utilized as, a service sink. A service sink shall not be utilized for the disposal of urine, fecal matter or other human waste.

2.22.8 **Ice prohibited in soiled utility room**. Machines for manufacturing ice, or any device for the handling or storage of ice, shall not be located in a soiled utility room.

2.22.9 **Sterilizer equipment requirements**. The approval and installation of all sterilizers shall conform to the requirements of the Saudi Building Code Mechanical Requirements SBC 501.

2.22.9.1 **Sterilizer piping**. Access for the purposes of inspection and maintenance shall be provided to all sterilizer piping and devices necessary for the operation of sterilizers.

2.22.9.2 **Steam supply**. Steam supplies to sterilizers, including those connected by pipes from overhead mains or branches shall be drained to prevent any moisture from reaching the sterilizer. The condensate drainage from the steam supply shall be discharged by gravity.

2.22.9.3 **Steam condensate return**. Steam condensate returns from sterilizers shall be a gravity return system.

2.22.9.4 **Condensers**. Pressure sterilizers shall be equipped with a means of condensing and cooling the exhaust steam vapors. Non-pressure sterilizers shall be equipped with a device that will automatically control the vapor, confining the vapors within the vessel.

2.22.10 **Special elevations**. Control valves, vacuum outlets and devices protruding from a wall of an operating, emergency, recovery, examining or delivery room, or in a corridor or other location where patients are transported on a wheeled stretcher, shall be located at an elevation that prevents bumping the patient or stretcher against the device.

SECTION 2.23
SPECIALTY PLUMBING FIXTURES

2.23.1 **Water connections**. Ornamental and lily pools, aquariums, ornamental fountain basins, swimming pools, and similar constructions, where provided with water supplies, shall be protected against backflow in accordance with Section 3.8.

2.23.2 **Approval**. Specialties requiring water and waste connections shall be submitted for approval.

SECTION 2.24
FAUCETS AND OTHER FIXTURE FITTINGS

2.24.1 **Approval**. Faucets and fixture fittings shall conform to ASME A112.18.1, CSA B125. Faucets and fixture fittings that supply drinking water for human ingestion shall conform to the requirements of NSF 61, Section 9. Flexible water connectors exposed to continuous pressure shall conform to the requirements of Section 3.5.6.

2.24.1.1 **Faucets and supply fittings**. Faucets and supply fittings shall conform to the water consumption requirements of Section 3.4.4.

2.24.1.2 **Waste fittings.** Waste fittings shall conform to one of the standards listed in Tables 4.2.1 and 4.2.4 for above-ground drainage and vent pipe and fittings, or the waste fittings shall be constructed of tubular stainless steel with a minimum wall thickness of 0.3 mm, tubular copper alloy having a minimum wall thickness of 0.7 mm or tubular plastic complying with ASTM F 409.

2.24.2 **Hand showers**. Hand-held showers shall conform to ASSE 1014, CSA Bl25 or approved equivalent standards.

2.24.3 **Shower valves**. Shower and tub-shower combination valves shall be balanced pressure, thermostatic or combination balanced-pressure/thermostatic valves that conform to the requirements of ASSE 1016, CSA B125. Multiple (gang) showers supplied with a single tempered water supply pipe shall have the water supply for such showers controlled by a master thermostatic mixing valve complying with ASSE 1017. Shower and tub-shower combination valves and master thermostatic mixing valves required by this section shall be equipped with a means to limit the maximum setting of the valve to 50^0C, which shall be field adjusted in accordance with the manufacturer's instructions.

2.24.4 **Hose-connected outlets**. Faucets and fixture fittings with hose-connected outlets shall conform to ASME A112.18.3M.

2.24.5 **Temperature-actuated, flow reduction valves for individual fixture fittings**. Temperature-actuated, flow reduction devices, where installed for individual fixture fittings, shall conform to ASSE 1062. Such valves shall not be used alone as a substitute for the balanced pressure, thermostatic or combination shower valves required in Section 2.24.3.

2.24.6 **Transfer valves**. Deck-mounted bath/shower transfer valves containing an integral atmospheric vacuum breaker shall conform to the requirements of ASME A112.18.7.

SECTION 2.25
FLUSHING DEVICES FOR WATER CLOSETS AND URINALS

2.25.1 **Flushing devices required**. Each water closet, urinal, clinical sink and any plumbing fixture that depends on trap siphonage to discharge the fixture contents to the drainage system shall be provided with a flushometer valve, flushometer tank or a flush tank designed and installed to supply water in quantity and rate of flow to flush the contents of the fixture, cleanse the fixture and refill the fixture trap.

2.25.1.1 **Separate for each fixture**. A flushing device shall not serve more than one fixture.

2.25.2 **Flushometer valves and tanks**. Flushometer valves and tanks shall comply with SASO 1477/1999. Vacuum breakers on flushometer valves shall conform to the performance requirements of ASSE 1001, CAN/CSA-B64.l.l. Access shall be provided to vacuum breakers. Flushometer valves shall be of the water-conservation type and shall not be utilized where the water pressure is lower than the minimum required for normal operation. When operated, the valve shall automatically complete the cycle of operation, opening fully and closing positively under the water supply pressure. Each flushometer valve shall be provided with a means for regulating the flow through the valve. The trap seal to the fixture shall be automatically refilled after each valve flushing cycle.

2.25.3 **Flush tanks**. Flush tanks equipped for manual flushing shall be controlled by a device designed to refill the tank after each discharge and to shutoff completely the water flow to the tank when the tank is filled to operational capacity. The trap seal to the fixture shall be automatically refilled after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled with a timing device or sensor control devices.

2.25.3.1 **Fill valves**. All flush tanks shall be equipped with an antisiphon fill valve conforming to SASO 1480/1999. The fill valve backflow preventer shall be located at least 25 mm above the full opening of the overflow pipe.

2.25.3.2 **Overflows in flush tanks**. Flush tanks shall be provided with overflows discharging to the water closet or urinal connected thereto and shall be sized to prevent flooding the tank at the maximum rate at which the tanks are supplied with water according to the manufacturer's design conditions. The opening of the overflow pipe shall be located above the flood level rim of the water closet or urinal or above a secondary overflow in the flush tank.

2.25.3.3 **Sheet copper**. Sheet copper utilized for flush tank linings shall conform to ASTM B152, and shall not weigh less than 0.03 kg/m^2.

2.25.3.4 **Access required**. All parts in a flush tank shall be accessible for repair and replacement.

2.25.4 **Flush pipes and fittings**. Flush pipes and fittings shall be of nonferrous material and shall conform to ASME A112.19.5 and CSA Bl25.

SECTION 2.26
MANUAL FOOD AND BEVERAGE DISPENSING EQUIPMENT

2.26.1 **Approval**. Manual food and beverage dispensing equipment shall conform to the requirements of NSF 18.

SECTION 2.27
FLOOR SINKS

2.27.1 **Approval**. Sanitary floor sinks shall conform to the requirements of ASME A112.6.7.

SECTION 2.28
WATER HEATERS

2.28.1 **Location**. Water heaters and storage tanks shall be located and connected so as to provide access for observation, maintenance, servicing and replacement.

2.28.2 **Drain valves**. Drain valves for emptying shall be installed at the bottom of each tank-type water heater and hot water storage tank. Drain valves shall conform to ASSE 1005.

2.28.3 **Water heater labeling**. All water heaters shall be third-party certified.

2.28.4 **Pressure marking of storage tanks**. Storage tanks and water heaters installed for domestic hot water shall have the maximum allowable working pressure clearly and indelibly stamped in the metal or marked on a plate welded thereto or otherwise permanently attached. Such markings shall be in an accessible position outside of the tank so as to make inspection or reinspection readily possible.

2.28.5 **Temperature controls**. All hot water supply systems shall be equipped with automatic temperature controls capable of adjustments from the lowest to the highest acceptable temperature settings for the intended temperature operating range.

2.28.6 **Water temperature control in piping from tankless heaters**. The temperature of water from tankless water heaters shall be a maximum of 60^{o}C when intended for domestic uses. This provision shall not supersede the requirement for protective shower valves in accordance with Section 2.24.3.

2.28.7 **Insulation.** Water heaters shall be installed in accordance with the manufacturer's installation instructions. Oil-fired water heaters shall conform to the requirements of these requirements SBC 701 and the Saudi Building Code Mechanical requirements SBC 501. Electric water heaters shall conform to these requirements SBC 701 and provisions of the Saudi Building Code Electrical requirements SBC 401.

2.28.8 **Rooms used as a plenum**. Water heaters using solid, liquid or gas fuel shall not be installed in a room containing air-handling machinery when such room is used as a plenum.

2.28.9 **Water heaters installed in attics**. Attics containing a water heater shall be provided with an opening and unobstructed passageway large enough to allow removal of the water heater. The passageway shall not be less than 0.75 m high and 0.6 m wide and not more than 6 m in length when measured along the centerline of the passageway from the opening to the water heater. The passageway shall have continuous solid flooring not less than 0.6 m wide. A level service space at least 0.75 m deep and 0.75 m wide shall be present at the front or service side of the water heater. The clear access opening dimensions shall be a minimum of 0.5 m by 0.75 m where such dimensions are large enough to allow removal of the water heater.

2.28.10 **Seismic supports**. Where earthquake loads are applicable in accordance with the Saudi Structural Code SBC 301, water heater supports shall be designed and installed for the seismic forces in accordance with the Saudi Structural Code SBC 301.

2.28.11 **Connections.** The cold water branch line from the main water supply line to each hot water storage tank or water heater shall be provided with a valve, located near the equipment and serving only the hot water storage tank or water heater. The valve shall not interfere or cause a disruption of the cold water supply to the remainder of the cold water system. The valve shall be provided with access on the same floor level as the water heater served.

2.28.12 **Water circulation**. The method of connecting a circulating water heater to the tank shall provide proper circulation of water through the water heater. The pipe or tubes required for the installation of appliances that will draw from the water heater or storage tank shall comply with the provisions of these requirements SBC 701 for material and installation.

Exception: Water circulation not required for localized water heater within the same space.

2.28.13 Safety devices.

2.28.13.1 Anti-siphon devices. An approved means, such as a cold water "dip" tube with a hole at the top or a vacuum relief valve installed in the cold water supply line above the top of the heater or tank, shall be provided to prevent siphoning of any storage water heater or tank.

2.28.13.2 Vacuum relief valve. Bottom fed water heaters and bottom fed tanks connected to water heaters shall have a vacuum relief valve installed. The vacuum relief valve shall comply with ANSI Z21.22.

2.28.13.3 Shutdown. A means for disconnecting an electric hot water supply system from its energy supply shall be provided in accordance with the Saudi Building Code Electrical Requirements SBC 401. A separate valve shall be provided to shut off the energy fuel supply to all other types of hot water supply systems.

2.28.13.4 Relief valve. All storage water heaters operating above atmospheric pressure shall be provided with an approved, self-closing (levered) pressure relief valve and temperature relief valve or combination thereof. The relief valve shall conform to ANSI Z21.22. The relief valve shall not be used as a means of controlling thermal expansion. Such valves shall be installed in the shell of the water heater tank. Temperature relief valves shall be so located in the tank as to be actuated by the water in the top 0.15 m of the tank served. For installations with separate storage tanks, the valves shall be installed on the tank and there shall not be any type of valve installed between the water heater and the storage tank. There shall not be a check valve or shutoff valve between a relief valve and the heater or tank served.

2.28.13.5 Relief valve approval. Temperature and pressure relief valves, or combinations thereof, and energy cutoff devices shall bear the label of an approved agency and shall have a temperature setting of not more than 99^{o}C and a pressure setting not exceeding the tank or water heater manufacturer's rated working pressure or 1000 kPa, whichever is less. The relieving capacity of each pressure relief valve and each temperature relief valve shall equal or exceed the heat input to the water heater or storage tank.

2.28.13.6 Relief outlet waste. The outlet of a pressure, temperature or other relief valve shall not be directly connected to the drainage system. The relief valve shall discharge full size to a safe place of disposal such as the floor, outside the building, or an indirect waste receptor. The discharge pipe shall not have any trapped sections and shall have a visible air gap or air gap fitting located in the same room as the water heater. The outlet end of the discharge pipe shall not be threaded and such discharge pipe shall not have a valve or tee installed. Relief valve piping shall be piped independent of other equipment drains or relief valve discharge piping to the disposal point. Such pipe shall be installed in a manner that does not cause personal injury to occupants in the immediate area or structural damage to the building. Relief valve discharge piping shall be of those materials listed in Section 3.5.5 or shall be tested, rated and approved for such use in accordance with ASME A112.4.l. Piping from safety pan drains shall be of those materials listed in Table 3.5.4.

2.28.13.7 Required pan. Where water heaters or hot water storage tanks are installed in locations where leakage of the tanks or connections will cause damage, the tank or water heater shall be installed in a galvanized steel pan having a minimum thickness of 1.25 mm or other pans approved for such use.

The pan shall be not less than 40 mm deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe having a minimum diameter of 20 mm. The pan drain shall extend full-size and terminate over a suitably located indirect waste receptor or floor drain or extend to the exterior of the building and terminate not less than 0.15 m and not more than 0.6 m above the adjacent ground surface.

2.28.14 Insulation.

2.28.14.1 Unfired vessel insulation. Unfired hot water storage tanks shall be insulated so that heat loss is limited to a maximum of 45 W/m^2 of external tank surface area. For purposes of determining this heat loss, the design ambient temperature shall not be higher than 18°C.

CHAPTER 3
WATER SUPPLY AND DISTRIBUTION SYSTEMS

SECTION 3.1
GENERAL

3.1.1 **Scope.** This chapter shall govern the materials, design and installation of water supply systems, both hot and cold, for utilization in connection with human occupancy and habitation and shall govern the installation of individual water supply systems.

3.1.2 **Solar energy utilization.** Solar energy systems used for heating potable water or using an independent medium for heating potable water shall comply with the applicable requirements of these code requirements SBC 701. The use of solar energy shall not compromise the requirements for cross connection or protection of the potable water supply system required by these code requirements SBC 701.

3.1.3 **Existing piping used for grounding.** Existing metallic water service piping used for electrical grounding shall not be replaced with nonmetallic pipe or tubing until other approved means of grounding is provided.

3.1.4 **Tests.** The potable water distribution system shall be tested in accordance with Section 1.12.5.

SECTION 3.2
WATER REQUIRED

3.2.1 **General.** Every structure equipped with plumbing fixtures and utilized for human occupancy or habitation shall be provided with a potable supply of water in the amounts and at the pressures specified in this chapter.

3.2.2 **Potable water required.** Only potable water shall be supplied to plumbing fixtures that provide water for drinking, bathing or culinary purposes, or for the processing of food, medical or pharmaceutical products. Unless otherwise provided in these code requirements SBC 701, potable water shall be supplied to all plumbing fixtures.

3.2.3 **Individual water supply.** Where a potable public water supply is not available, individual sources of potable water supply shall be utilized.

3.2.3.1 **Sources.** Dependent on geological and soil conditions and the amount of rainfall, individual water supplies are wells and cistern provided they are properly treated by approved means of treatment.

3.2.3.2 **Minimum quantity.** The combined capacity of the source and storage in an individual water supply system shall supply the fixtures with water at rates and pressures as required by this chapter.

3.2.3.3 **Water quality.** Water from an individual water supply shall be approved as potable by Ministry of Water and Electricity prior to connection to the plumbing system.

3.2.3.4 **Disinfection of system.** After construction or major repair, the individual water supply system shall be purged of deleterious matter and disinfected in accordance with Section 3.10.

3.2.3.5 **Pumps.** Pumps shall be rated for the transport of potable water. Pumps in an individual water supply system shall be constructed and installed so as to prevent contamination from entering a potable water supply through the pump units. Pumps shall be sealed to the well casing or covered with a water-tight seal. Pumps shall be designed to maintain a prime and installed such that ready access is provided to the pump parts of the entire assembly for repairs.

3.2.3.5.1 **Pump enclosure.** The pump room or enclosure around a well pump shall be drained and protected from freezing by heating or other approved means. Where pumps are installed in basements, such pumps shall be mounted on a block or shelf not less than 0.45 m above the basement floor. Well pits shall be prohibited.

SECTION 3.3
WATER SERVICE PIPE

3.3.1 **Size of water service pipe.** The water service pipe shall be sized to supply water to the structure in the quantities and at the pressures required in these code requirements SBC 701. The minimum diameter of water service pipe shall be 20 mm.

3.3.2 **Separation of water service and building sewer.** Water service pipe shall be separated from building sewer by 1.5 m of undisturbed or compacted earth.

Exceptions:

1. The required separation distance shall not apply where the bottom of the water service pipe within 1.5 m of the sewer is a minimum of 0.5 m above the top of the highest point of the sewer and the pipe materials conform to Section 4.3.1.
2. Water service pipe is permitted to be located in the same trench with a building sewer, provided such sewer is constructed of materials listed in Table 4.2.2.
3. The required separation distance shall not apply where a water service pipe crosses a sewer pipe provided the water service pipe is sleeved to at least 1.5 m horizontally from the sewer pipe centerline, on both sides of such crossing with pipe materials listed in Table 3.5.3, Table 4.2.2 or Table 4.2.3.

3.3.2.1 **Water service pipe near sources of pollution.** Potable water service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits (see Section 3.5.1 for soil and groundwater conditions).

SECTION 3.4
DESIGN OF BUILDING WATER DISTRIBUTION SYSTEM

3.4.1 **General.** The design of the water distribution system shall conform to accepted engineering practice. Methods utilized to determine pipe sizes shall be approved.

3.4.2 **System interconnection.** At the points of interconnection between the hot and cold water supply piping systems at the individual fixtures, appliances or devices, provisions shall be made to prevent flow between such piping systems.

3.4.3 **Water distribution system design criteria.** The water distribution system shall be designed, and pipe sizes shall be selected such that under conditions of peak demand, the capacities at the fixture supply pipe outlets shall not be less than shown in Table 3.4.3. The minimum flow rate and flow pressure provided to fixtures and appliances not listed in Table 3.4.3 shall be in accordance with the manufacturer's installation instructions.

TABLE 3.4.3
WATER DISTRIBUTION SYSTEM DESIGN CRITERIA
REQUIRED CAPACITY AT FIXTURE SUPPLY PIPE OUTLETS

FIXTURE SUPPLY OUTLET SERVING	FLOW RATE [a] L/m	FLOW PRESSURE kPa
Bathtub	15	50
Bidet	7.5	25
Combination fixture	15	50
Dishwasher, residential	10	50
Drinking fountain	3	50
Laundry tray	15	50
Lavatory (wash-basin)	7.5	50
Shower	12	50
Shower, temperature controlled	12	130
Sillcock, hose bibb	20	50
Sink, kitchen	10	50
Sink, service	12	50
Urinal, valve	55	100
Water closet, blow out, flushometer valve	130	170
Water closet, flushometer tank	6	100
Water closet, siphonic, flushometer valve	95	100
Water closet, tank, close coupled	12	50
Water closet, tank, one piece	22	130

a. For additional requirements for flowrates and quantities, see Section 3.4.4.

3.4.4 **Maximum flow and water consumption.** The maximum water consumption flow rates and quantities for all plumbing fixtures and fixture fittings shall be in accordance with Table 3.4.4.

Exceptions:

1. Vegetable sprays.
2. Clinical sinks [17 L per flushing cycle].
3. Service sinks.
4. Emergency showers.

3.4.5 **Size of fixture supply.** The minimum size of a fixture supply pipe shall be as shown in Table 3.4.5. The fixture supply pipe shall not terminate more than 0.8 m from the point of connection to the fixture. A reduced-size flexible water connector installed between the supply pipe and the fixture shall be of an approved type. The supply pipe shall extend to the floor or wall adjacent to the fixture. The minimum size of individual distribution lines utilized in parallel water distribution systems shall be as shown in Table 3.4.5.

TABLE 3.4.4
MAXIMUM FLOW RATES AND CONSUMPTION FOR PLUMBING FIXTURES AND FIXTURE FITTINGS

PLUMBING FIXTURE OR FIXTURE FITTING	MAXIMUM FLOW RATE OR QUANTITY [b]
Lavatory (wash-basin), private	8 L/m at 415 kPa
Lavatory (wash-basin), public, (metering)	1 L per metering cycle
Lavatory (wash-basin), public (other than metering)	2 L/m at 415 kPa
Shower head [a]	10 L/m at 550 kPa
Sink faucet	8 L/m at 415 kPa
Urinal	4 L per flushing cycle
Water closet	6 L per flushing cycle
Wadhua tap (metering)	1 L per metering cycle
Wadhua tap (other than metering)	2 L/m at 415 kPa

a. A hand-held shower spray is a shower head.
b. Consumption tolerances shall be determined from referenced standards.

3.4.6 **Variable street pressures.** Where street water main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.

3.4.7 **Inadequate water pressure.** Wherever water pressure from the street main or other source of supply is insufficient to provide flow pressures at fixture outlets as required under Table 3.4.3, a water pressure booster system conforming to Section 3.6.5 shall be installed on the building water supply system.

3.4.8 **Water-pressure reducing valve or regulator.** Where water pressure within a building exceeds 550 kPa static, an approved water-pressure reducing valve conforming to ASSE 1003 with strainer shall be installed to reduce the pressure in the building water distribution piping to 550 kPa static or less.
Exception: Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 550 kPa or less at individual fixtures.

3.4.8.1 **Valve design.** The pressure-reducing valve shall be designed to remain open to permit uninterrupted water flow in case of valve failure.

3.4.8.2 **Repair and removal.** All water-pressure reducing valves, regulators and strainers shall be so constructed and installed as to permit repair or removal of parts without breaking a pipeline or removing the valve and strainer from the pipeline.

3.4.9 **Water hammer.** The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water-hammer arrestor shall be installed where quick-closing valves are utilized. Water-hammer arrestors shall be installed in accordance with the manufacturer's specifications. Water-hammer arrestors shall conform to ASSE 1010.

TABLE 3.4.5
MINIMUM SIZES OF FIXTURE WATER SUPPLY PIPES

FIXTURE	MINIMUM PIPE SIZE[b] (mm)
Bathtubs [a] (1.5 m x 0.8 m) and smaller	15
Bathtubs [a] (larger than 1.5 m x 0.8 m)	15
Bidet	15
Combination sink and tray	15
Dishwasher, domestic [a]	15
Drinking fountain	15
Hose bibbs	15
Kitchen sink [a]	15
Laundry, 1, 2 or 3 compartments [a]	15
Lavatory (wash-basin)	15
Shower, single head [a]	15
Sinks, flushing rim	20
Sinks, service	15
Urinal, flush tank	15
Urinal, flush valve	20
Wall hydrant	15
Water closet, flush tank	15
Water closet, flush valve	25
Water closet, flushometer tank	15
Water closet, one piece [a]	15
Wadhua tap	15
Istenja spray	15

a. Where the developed length of the distribution line is 20 m or less, and the available pressure at the meter is a minimum of 240 kPa, the minimum size of an individual distribution line supplied from a manifold and installed as part of a parallel water distribution system shall be one nominal tube size smaller than the sizes indicated.

b. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

3.4.10 **Parallel water distribution system manifolds.** Hot water and cold water manifolds installed with parallel connected individual distribution lines to each fixture or fixture fitting shall be designed in accordance with Sections 3.4.10.1 through 3.4.10.3.

3.4.10.1 **Manifold sizing.** Hot water and cold water manifolds shall be sized in accordance with Table 3.4.10.1. The total liters per minute is the demand of all outlets supplied.

TABLE 3.4.10.1
MANIFOLD SIZING

NOMINAL SIZE INTERNAL DIAMETER (mm)	MAXIMUM DEMAND (L/m)	
	Velocity at 1.2 m/sec	Velocity at 2.4 m/sec
15	7.5	19
20	23	42
25	38	76
32	57	117
40	83	167

3.4.10.2 **Valves**. Individual fixture shutoff valves installed at the manifold shall be identified as to the fixture being supplied.

3.4.10.3 **Access.** Access shall be provided to manifolds.

3.4.11 **Individual pressure balancing in-line valves for individual fixture fittings.** Where individual pressure balancing in-line valves for individual fixture fittings are installed, such valves shall comply with ASSE 1066. Such valves shall be installed in an accessible location and shall not be utilized alone as a substitute for the balanced pressure, thermostatic or combination shower valves required in Section 2.24.3.

SECTION 3.5
MATERIALS, JOINTS AND CONNECTIONS

3.5.1 **Soil and ground water.** The installation of a water service or water distribution pipe shall be prohibited in soil and groundwater contaminated with solvents, fuels, organic compounds or other detrimental materials causing permeation, corrosion, degradation or structural failure of the piping material. Where detrimental conditions are suspected, a chemical analysis of the soil and ground water conditions shall be required to ascertain the acceptability of the water service or water distribution piping material for the specific installation. Where detrimental conditions exist, approved alternative materials or routing shall be required.

3.5.2 **Lead content of water supply pipe and fittings.** Pipe and pipe fittings, including valves and faucets, utilized in the water supply system shall have a maximum of 8-percent lead content.

3.5.3 **Water service pipe.** Water service pipe shall conform to NSF 61 and shall conform to one of the standards listed in Table 3.5.3. All water service pipes or tubing, installed underground and outside of the structure, shall have a minimum working pressure rating of 1100 kPa at 25°C. Where the water pressure exceeds 1100 kPa, piping material shall have a minimum rated working pressure equal to the highest available pressure. Plastic water service piping shall terminate within 1.5 m inside of the point where the pipe penetrates an exterior wall or slab on grade. All ductile iron water pipe shall be cement mortar lined in accordance with AWWA C104.

3.5.3.1 **Dual check-valve-type backflow preventer.** Where a dual check-valve backflow preventer is installed on the water supply system, it shall comply with ASSE 1024.

TABLE 3.5.3
WATER SERVICE PIPE

PIPE MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 1527; ASTM D 2282
Brass pipe	ASTM B 43
Chlorinated polyvinyl chloride (CPVC) plastic pipe	SASO 1517/1999
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 447
Cross-linked polyethylene (PEX) plastic tubing	ASTM F 876; ASTM F 877; CSA-B137.5
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	ASTM F 1281; CAN/CSA B137.10M
Ductile iron water pipe	AWWA C151; AWWA C115
Galvanized steel pipe	ASTM A 53
Polybutylene (PB) plastic pipe and tubing	SASO 862/1994
Polyethylene (PE) plastic pipe	SASO 1401/1998
Polyethylene (PE) plastic tubing	ASTM D 2737; CSA B137.1
Polyethylene/aluminum/polethylene (PE-AL-PE) pipe	ASTM F 1282 CAN/CSA-B137.9
Polyvinyl chloride (PVC) plastic pipe	ASTM D 1785; ASTM D 2241; ASTM D 2672; CSA-B137.3
Stainless steel pipe (Type 304/304L)	ASTM A 312; ASTM A 778
Stainless steel pipe (Type 316/316L)	ASTM A 312; ASTM A 778

3.5.4 **Water distribution pipe.** Water distribution pipe shall conform to SASO to NSF 61 and shall conform to one of the standards listed in Table 3.5.4. All hot water distribution pipe and tubing shall have a minimum pressure rating of 700 kPa at 80°C.

TABLE 3.5.4
WATER DISTRIBUTION PIPE

MATERIAL	STANDARD
Brass pipe	ASTM B 43
Chlorinated polyvinyl chloride (CPVC) plastic pipe and tubing	SASO 1517/1999
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 447
Cross-linked polyethylene (PEX) plastic tubing	ASTM F 877; CSA-B137.5
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	ASTM F 1281; CAN/CSA-B137.10M
Galvanized steel pipe	ASTM A 53
Polybutylene (PB) plastic pipe and tubing	ASTM D 3309; CAN3-B137.8M
Polyethylene/Aluminum/Polyethylene (PE-AL-PE) composite pipe	ASTM F 1282
Stainless steel pipe (Type 304/304L)	ASTM A 312; ASTM A 778
Stainless steel pipe (Type 316/316L)	ASTM A 312; ASTM A 778

3.5.5 **Fittings.** Pipe fittings shall be approved for installation with the piping material installed and shall conform to the respective pipe standards or one of the standards listed in Table 3.5.5. All pipe fittings utilized in water supply systems shall also conform to NSF 61. The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow in the piping. Ductile and gray iron pipe fittings shall be cement mortar lined in accordance with AWWA C104.

3.5.5.1 **Mechanically formed tee fittings.** Mechanically extracted outlets shall have a height not less than three times the thickness of the branch tube wall.

TABLE 3.5.5
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic	ASTM D 2468
Cast-iron	ASME B16.4; ASME B16.12
Chlorinated polyvinyl chloride (CPVC) plastic	ASTM F 437; ASTM F 438; ASTM F 439
Copper or copper alloy	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29
Fittings for cross-linked polyethylene (PEX) plastic tubing	ASTM F 1807, ASTM F 1960, ASTM F 2080
Gray iron and ductile iron	AWWA C 110; AWWA C 153
Malleable iron	ASME B16.3
Metal (brass) insert fittings for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) and Cross-linked Polyethylene/ Aluminum/Polyethylene (PEX-AL-PEX)	ASTM F 1974
Polyethylene (PE) plastic	ASTM D 2609
Polyvinyl chloride (PVC) plastic	ASTM D 2464; ASTM D 2466; ASTM D 2467; CSA-B137.2
Stainless steel (Type 304/304L)	ASTM A 312; ASTM A 778
Stainless steel (Type 316/316L)	ASTM A 312; ASTM A 778
Steel	ASME B16.9; ASME B16.11; ASME B16.28

3.5.5.1.1 **Full flow assurance.** Branch tubes shall not restrict the flow in the run tube. A dimple/depth stop shall be formed in the branch tube to ensure that penetration into the collar is of the correct depth. For inspection purposes, a second dimple shall be placed 7 mm above the first dimple. Dimples shall be aligned with the tube run.

3.5.5.1.2 **Brazed joints.** Mechanically formed tee fittings shall be brazed in accordance with Section 3.5.14.1.

3.5.6 **Flexible water connectors.** Flexible water connectors exposed to continuous pressure shall conform to ASME A112.18.6. Access shall be provided to all flexible water connectors.

3.5.7 **Valves.** All valves shall be of the approved type and compatible with the type of piping material installed in the system.

3.5.8 **Manufactured pipe nipples.** Manufactured pipe nipples shall conform to one of the standards listed in Table 3.5.8.

TABLE 3.5.8
MANUFACTURED PIPE NIPPLES

MATERIAL	STANDARD
Brass-, copper-, chromium-plated	ASTM B 687
Steel	ASTM A 733

3.5.9 **Prohibited joints and connections.** The following types of joints and connections shall be prohibited:

1. Cement or concrete joints.
2. Joints made with fittings not approved for the specific installation.
3. Solvent-cement joints between different types of plastic pipe.

4. Saddle-type fittings.

3.5.10 **ABS plastic joints.** Joints between ABS plastic pipe or fittings shall comply with Sections 3.5.10.1 through 3.5.10.3.

3.5.10.1 **Mechanical joints.** Mechanical joints on water pipes shall be made with an elastomeric seal conforming to ASTM D 3139. Mechanical joints shall only be installed in underground systems, unless otherwise approved. Joints shall be installed only in accordance with the manufacturer's instructions.

3.5.10.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. Solvent cement that conforms to ASTM D 2235 shall be applied to all joint surfaces. The joint shall be made while the cement is wet. Joints shall be made in accordance with ASTM D 2235. Solvent-cement joints shall be permitted above or below ground.

3.5.10.3 **Threaded joints.** Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

3.5.11 **Brass joints.** Joints between brass pipe or fittings shall comply with Sections 3.5.11.1 through 3.5.11.4.

3.5.11.1 **Brazed joints.** All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

3.5.11.2 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.11.3 **Threaded joints.** Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

3.5.11.4 **Welded joints.** All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

3.5.12 **Gray iron and ductile iron joints**. Joints for gray and ductile iron pipe and fittings shall comply with AWWA C111 and shall be installed in accordance with the manufacturer's installation instructions.

3.5.13 **Copper pipe joints.** Joints between copper or copper-alloy pipe or fittings shall comply with Sections 3.5.13.1 through 3.5.13.5.

3.5.13.1 **Brazed joints.** All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

3.5.13.2 **Mechanical joints**. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.13.3 **Soldered joints.** Solder joints shall be made in accordance with the methods of ASTM B 828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B 813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32. The joining of water supply piping shall be made with lead-free solder and fluxes. "Lead free" shall mean a chemical composition equal to or less than 0.2-percent lead.

3.5.13.4 **Threaded joints.** Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

3.5.13.5 **Welded joints.** All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

3.5.14 **Copper tubing joints.** Joints between copper or copper-alloy tubing or fittings shall comply with Sections 3.5.14.1 through 3.5.14.4.

3.5.14.1 **Brazed joints.** All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

3.5.14.2 **Flared joints.** Flared joints for water pipe shall be made by a tool designed for that operation.

3.5.14.3 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.14.4 **Soldered joints.** Solder joints shall be made in accordance with the methods of ASTM B 828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B 813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32. The joining of water supply piping shall be made with lead-free solders and fluxes. "Lead free" shall mean a chemical composition equal to or less than 0.2-percent lead.

3.5.15 **CPVC plastic joints.** Joints between CPVC plastic pipe or fittings shall comply with Sections 3.5.15.1 through 3.5.15.3.

3.5.15.1 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.15.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture, and an approved primer shall be applied. Solvent cement, orange in color and conforming to ASTM F 493, shall be applied to all joint surfaces. The joint shall be made while the cement is wet, and in accordance with ASTM D 2846 or ASTM F 493. Solvent-cement joints shall be permitted above or below ground.

Exception: A primer is not required where all of the following conditions apply:

1. The solvent cement used is third-party certified as conforming to ASTM F 493.

2. The solvent cement used is yellow in color.

3. The solvent cement is used only for joining 15 mm through 50 mm diameter CPVC pipe and fittings.

4. The CPVC pipe and fittings are manufactured in accordance with ASTM D 2846.

3.5.15.3 **Threaded joints.** Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe, but the pressure rating of the pipe shall be reduced by 50 percent. Thread by socket molded fittings shall be permitted. Approved thread lubricant or tape shall be applied on the male threads only.

3.5.16 **Cross-linked polyethylene plastic joints.** Joints between cross-linked polyethylene plastic tubing or fittings shall comply with Sections 3.5.16.1 and 3.5.16.2.

3.5.16.1 **Flared joints.** Flared pipe ends shall be made by a tool designed for that operation.

3.5.16.2 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions. Fittings for cross-linked polyethylene (PEX) plastic tubing as described in ASTM F 1807, ASTM F 1960 and ASTM F 2080 shall be installed in accordance with the manufacturer's instructions.

3.5.17 **Steel joints.** Joints between galvanized steel pipe or fittings shall comply with Sections 3.5.17.1 and 3.5.17.2.

3.5.17.1 **Threaded joints.** Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

3.5.17.2 **Mechanical joints.** Joints shall be made with an approved elastomeric seal. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.18 **Polybutylene plastic joints.** Joints between polybutylene plastic pipe and tubing or fittings shall comply with Sections 3.5.18.1 through 3.5.18.3.

3.5.18.1 **Flared joints.** Flared pipe ends shall be made by a tool designed for that operation.

3.5.18.2 **Heat-fusion joints.** Joints shall be of the socket-fusion or butt-fusion type. Joint surfaces shall be clean and free from moisture. All joint surfaces shall be heated to melt temperature and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D 2657, ASTM D 3309 or CAN3-B137.8M.

3.5.18.3 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions. Metallic lock rings employed with insert fittings as described in ASTM D 3309 or CAN3-B137.8M shall be installed in accordance with the manufacturer's instructions.

3.5.19 **Polyethylene plastic joints.** Joints between polyethylene plastic pipe and tubing or fittings shall comply with Sections 3.5.19.1 through 3.5.19.4.

3.5.19.1 **Flared joints.** Flared joints shall be permitted where so indicated by the pipe manufacturer. Flared joints shall be made by a tool designed for that operation.

3.5.19.2 **Heat-fusion joints.** Joint surfaces shall be clean and free from moisture. All joint surfaces shall be heated to melt temperature and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D 2657.

3.5.19.3 **Mechanical joints**. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.19.4 **Installation.** Polyethylene pipe shall be cut square, with a cutter designed for plastic pipe. Except where joined by heat fusion, pipe ends shall be chamfered to remove sharp edges. Kinked pipe shall not be installed. The minimum pipe bending radius shall not be less than 30 pipe diameters, or the minimum coil radius, whichever is greater. Piping shall not be bent beyond straightening of the curvature of the coil. Bends shall not be permitted within 10 pipe diameters of any fitting or valve. Stiffener inserts installed with compression-type couplings and fittings shall not extend beyond the clamp or nut of the coupling or fitting.

3.5.20 **PVC plastic joints.** Joints between PVC plastic pipe or fittings shall comply with Sections 3.5.20.1 through 3.5.20.3.

3.5.20.1 **Mechanical joints.** Mechanical joints on water pipe shall be made with an elastomeric seal conforming to ASTM D 3139. Mechanical joints shall not be installed in above-ground systems unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

3.5.20.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564 or CSA-B137.3 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

3.5.20.3 **Threaded joints.** Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe, but the pressure rating of the pipe shall be reduced by 50 percent.

Thread by socket molded fittings shall be permitted. Approved thread lubricant or tape shall be applied on the male threads only.

3.5.21 **Stainless steel joints.** Joints between stainless steel pipe and fittings shall comply with Sections 3.5.21.1 and 3.5.21.2.

3.5.21.1 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

3.5.21.2 **Welded joints.** All joint surfaces shall be cleaned. The joint shall be welded autogenously or with an approved filler metal as referenced in ASTM A 312.

3.5.22 **Joints between different materials.** Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type, or as permitted in Sections 3.5.22.1, 3.5.22.2 and 3.5.22.3. Connectors or adapters shall have an elastomeric seal conforming to ASTM D 1869 or ASTM F 477. Joints shall be installed in accordance with the manufacturer's instructions.

3.5.22.1 **Copper or copper-alloy tubing to galvanized steel pipe.** Joints between copper or copper-alloy tubing and galvanized steel pipe shall be made with a brass fitting or dielectric fitting. The copper tubing shall be soldered to the fitting in an approved manner, and the fitting shall be screwed to the threaded pipe.

3.5.22.2 **Plastic pipe or tubing to other piping material.** Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting.

3.5.22.3 **Stainless steel.** Joints between stainless steel and different piping materials shall be made with a mechanical joint of the compression or mechanical sealing type or a dielectric fitting.

SECTION 3.6
INSTALLATION OF THE BUILDING WATER DISTRIBUTION SYSTEM

3.6.1 **Location of full-open valves.** Full-open valves shall be installed in the following locations:

1. On the building water service pipe from the public water supply near the curb.
2. On the water distribution supply pipe at the entrance into the structure.
3. On the discharge side of every water meter.
4. On the base of every water riser pipe in occupancies other than multiple-family residential occupancies that are two stories or less in height and in one- and two-family residential occupancies.
5. On the top of every water down-feed pipe in occupancies other than one- and two-family residential occupancies.
6. On the entrance to every water supply pipe to a dwelling unit, except where supplying a single fixture equipped with individual stops.
7. On the water supply pipe to a gravity or pressurized water tank.
8. On the water supply pipe to every water heater.

3.6.2 **Location of shutoff valves.** Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture other than bathtubs and showers in one- and two-family residential occupancies, and other than in individual guestrooms that are provided with unit shutoff valves in hotels, motels, boarding houses and similar occupancies.
2. On the water supply pipe to each sillcock.

3. On the water supply pipe to each appliance or mechanical equipment.

3.6.3 **Access to valves.** Access shall be provided to all required full-open valves and shutoff valves.

3.6.4 **Valve identification.** Service and hose bibb valves shall be identified. All other valves installed in locations that are not adjacent to the fixture or appliance shall be identified, indicating the fixture or appliance served.

3.6.5 **Water pressure booster systems.** Water pressure booster systems shall be provided as required by Sections 3.6.5.1 through 3.6.5.10.

3.6.5.1 **Water pressure booster systems required.** Where the water pressure in the public water main or individual water supply system is insufficient to supply the minimum pressures and quantities specified in these requirements SBC 701, the supply shall be supplemented by an elevated water tank, a hydropneumatic pressure booster system or a water pressure booster pump installed in accordance with Section 3.6.5.5.

3.6.5.2 **Support.** All water supply tanks shall be supported in accordance with the Saudi Building Code Structural Regulations SBC 300.

3.6.5.3 **Covers.** All water supply tanks shall be covered to keep out unauthorized persons, dirt and vermin. The covers of gravity tanks shall be vented with a return bend vent pipe with an area not less than the area of the down-feed riser pipe, and the vent shall be screened with a corrosion-resistant screen of not less than 650 by 800 mesh per m.

3.6.5.4 **Overflows for water supply tanks.** Each gravity or suction water supply tank shall be provided with an overflow with a diameter not less than that shown in Table 3.6.5.4. The overflow outlet shall discharge above and within not less than 0.15 m of a roof or roof drain, floor or floor drain, or over an open water-supplied fixture. The overflow outlet shall be covered with a corrosion-resistant screen of not less than 650 by 800 mesh per m and by 7 mm hardware cloth or shall terminate in a horizontal angle seat check valve. Drainage from overflow pipes shall be directed so as not to freeze on roof walks.

TABLE 3.6.5.4
SIZES FOR OVERFLOW PIPES FOR WATER SUPPLY TANKS

MAXIMUM CAPACITY OF WATER SUPPLY LINE TO TANK (L/m)	DIAMETER OF OVERFLOW PIPE (mm)
0 – 200	50
200 – 600	65
600 – 750	75
750 – 1,500	100
1,500 – 2,650	125
2,650 – 3,800	150
Over 3,800	200

3.6.5.5 **Low-pressure cutoff required on booster pumps.** A low-pressure cutoff shall be installed on all booster pumps in a water pressure booster system to prevent creation of a vacuum or negative pressure on the suction side of the pump when a positive pressure of 70 kPa or less occurs on the suction side of the pump.

3.6.5.6 **Potable water inlet control and location.** Potable water inlets to gravity tanks shall be controlled by a fill valve or other automatic supply valve installed so as to prevent the tank from overflowing. The inlet shall be terminated so as to provide an air gap not less than 0.1 m above the overflow.

3.6.5.7 **Tank drain pipes.** A valve pipe shall be provided at the lowest point of each tank to permit emptying of the tank. The tank drain pipe shall discharge as required for overflow pipes and shall not be smaller in size than specified in Table 3.6.5.7.

TABLE 3.6.5.7
SIZE OF DRAIN PIPES FOR WATER TANKS

TANK CAPACITY (Liters)	DRAIN PIPE (mm)
Up to 2,850	25
2,851 to 5,700	40
5,701 to 11,400	50
11,401 to 20,000	65
20,001 to 30,000	75
Over 30,000	100

3.6.5.8 **Prohibited location of potable supply tanks.** Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping or any source of contamination.

3.6.5.9 **Pressure tanks, vacuum relief.** All water pressure tanks shall be provided with a vacuum relief valve at the top of the tank that will operate up to a maximum water pressure of 1400 kPa and up to a maximum temperature of 90°C. The minimum size of such vacuum relief valve shall be 15 mm.

Exception: This section shall not apply to pressurized captive air diaphragm/bladder tanks.

3.6.5.10 **Pressure relief for tanks.** Every pressure tank in a hydropneumatic pressure booster system shall be protected with a pressure relief valve. The pressure relief valve shall be set at a maximum pressure equal to the rating of the tank. The relief valve shall be installed on the supply pipe to the tank or on the tank. The relief valve shall discharge by gravity to a safe place of disposal.

3.6.6 **Water supply system test.** Upon completion of a section of or the entire water supply system, the system, or portion completed, shall be tested in accordance with Section 1.12.

SECTION 3.7
HOT WATER SUPPLY SYSTEM

3.7.1 **Where required.** In residential occupancies, hot water shall be supplied to all plumbing fixtures and equipment utilized for bathing, washing, culinary purposes, cleansing, laundry or building maintenance. In nonresidential occupancies, hot water shall be supplied to all plumbing fixtures and equipment utilized for culinary purposes, cleansing, laundry or building maintenance. In nonresidential occupancies, hot water or tempered water shall be supplied for bathing and washing purposes. Tempered water shall be delivered from accessible hand-washing facilities.

3.7.2 **Hot water supply temperature maintenance.** Where the developed length of hot water piping from the source of hot water supply to the farthest fixture exceeds 30 m, the hot water supply system shall be provided with a method of maintaining the temperature in accordance with the Saudi Building Code Energy requirement SBC 601.

3.7.2.1 **Piping insulation.** Circulating hot water system piping shall be insulated in accordance with the Saudi Building Code Energy and Water Conservation Regulations SBC 600.

3.7.2.2 **Hot water system controls.** Automatic circulating hot water system pumps or heat trace shall be arranged to be conveniently turned off, automatically or manually, when the hot water system is not in operation.

3.7.2.3 **Recirculating pump.** Where a thermostatic mixing valve is used in a system with a hot water recirculating pump, the hot water or tempered water return line shall be routed to the cold water inlet pipe of the water heater and the coldwater inlet pipe or the hot water return connection of the thermostatic mixing valve.

3.7.3 **Thermal expansion control.** A means of controlling increased pressure caused by thermal expansion shall be provided where required in accordance with Sections 3.7.3.1 and 3.7.3.2.

3.7.3.1 **Pressure-reducing valve.** For water service system sizes up to and including 50 mm, a device for controlling pressure shall be installed where, because of thermal expansion, the pressure on the downstream side of a pressure-reducing valve exceeds the pressure-reducing valve setting.

3.7.3.2 **Backflow prevention device or check valve.** Where a backflow prevention device, check valve or other device is installed on a water supply system utilizing storage water heating equipment such that thermal expansion causes an increase in pressure, a device for controlling pressure shall be installed.

3.7.4 **Flow of hot water to fixtures.** Fixture fittings, faucets and diverters shall be installed and adjusted so that the flow of hot water from the fittings corresponds to the left-hand side of the fixture fitting.

Exception: Shower and tub/shower mixing valves conforming to ASSE 1016, where the flow of hot water corresponds to the markings on the device.

SECTION 3.8
PROTECTION OF POTABLE WATER SUPPLY

3.8.1 **General.** A potable water supply system shall be designed, installed and maintained in such a manner so as to prevent contamination from nonpotable liquids, solids or gases being introduced into the potable water supply through cross-connections or any other piping connections to the system. Backflow preventer applications shall conform to Table 3.8.1, except as specifically stated in Sections 3.8.2 through 3.8.16.9.

3.8.2 **Plumbing fixtures.** The supply lines or fittings for every plumbing fixture shall be installed so as to prevent backflow.

TABLE 3.8.1
APPLICATION OF BACKFLOW PREVENTERS

DEVICE	DEGREE OF HAZARD	APPLICATION	APPLICABLE STANDARDS
Air gap	High or low hazard	Backsiphonage or backpressure	ASME A112.1.2
Air gap fittings for use with plumbing fixtures, appliances and appurtenances	High or low hazard	Backsiphonage or backpressure	ASME A112.1.3
Antisiphon-type fill valves for gravity water closet flush tanks	High hazard	Backsiphonage only	ASSE 1002, CSA-B125
Barometric loop	High or low hazard	Backsiphonage only	(See Section 3.8.13.4)
Reduced pressure principle backflow preventer and reduced pressure principle fire protection backflow preventer	High or low hazard	Backpressure or backsiphonage Sizes 10 mm – 400 mm	ASSE 1013, AWWA C511, CAN/CSA B64.4
Reduced pressure detector fire protection backflow prevention assemblies	High or low hazard	Backsiphonage or backpressure (Fire sprinkler systems)	ASSE 1047
Double check backflow prevention assembly and double check fire protection backflow prevention assembly	Low hazard	Backpressure or backsiphonage Sizes 10 mm – 400 mm	ASSE 1015, AWWA C510
Double check detector fire protection backflow prevention assemblies	Low hazard	Backpressure or backsiphonage (Fire sprinkler systems) Sizes 50 mm – 400 mm	ASSE 1048
Dual-check-valve-type backflow preventer	Low hazard	Backpressure or backsiphonage Sizes 8 mm – 25 mm	ASSE 1024
Backflow preventer with intermediate atmospheric vents	Low hazard	Backpressure or backsiphonage Sizes 8 mm – 20 mm	ASSE 1012, CAN/CSA-B64.3
Backflow preventer for carbonated beverage machines	Low hazard	Backpressure or backsiphonage Sizes 8 mm – 10 mm	ASSE 1022
Pipe-applied atmospheric-type vacuum breaker	High or low hazard	Backsiphonage only Sizes 8 mm – 100 mm	ASSE 1001, CAN/CSA-B64.1.1
Pressure vacuum breaker assembly	High or low hazard	Backsiphonage only Sizes 15 mm – 50 mm	ASSE 1020
Hose-connection vacuum breaker	High or low hazard	Low head backpressure or backsiphonage Sizes 15 mm, 20 mm, 25 mm	ASSE 1011, CAN/CSA-B64.2
Vacuum breaker wall hydrants, frost-resistant, automatic draining type	High or low hazard	Low head backpressure or backsiphonage Sizes 20 mm, 25 mm	ASSE 1019, CAN/CSA-B64.2.2
Laboratory faucet backflow preventer	High or low hazard	Low head backpressure and backsiphonage	ASSE 1035, CSA B64.7
Hose connection backflow preventer	High or low hazard	Low head backpressure, rated working pressure backpressure or backsiphonage Sizes 15 mm – 25 mm	ASSE 1052
Spillproof vacuum breaker	High or low hazard	Backsiphonage only Sizes 8 mm – 50 mm	ASSE 1056

3.8.3 **Devices, appurtenances, appliances and apparatus.** All devices, appurtenances, appliances and apparatus intended to serve some special function, such as sterilization, distillation, processing, cooling, or storage of ice or foods, and that connect to the water supply system, shall be provided with protection against backflow and contamination of the water supply system. Water pumps, filters, softeners, tanks and all other appliances and devices that handle or treat potable water shall be protected against contamination.

3.8.3.1 **Special equipment, water supply protection.** The water supply for hospital fixtures shall be protected against backflow with a reduced pressure principle backflow preventer, an atmospheric or spill-proof vacuum breaker, or an air gap. Vacuum breakers for bedpan washer hoses shall not be located less than 1.5 m above the floor. Vacuum breakers for hose connections in health care or laboratory areas shall not be less than 1.8 m above the floor.

3.8.4 **Water service piping.** Water service piping shall be protected in accordance with Sections 3.3.2 and 3.3.2.1.

3.8.5 **Chemicals and other substances.** Chemicals and other substances that produce either toxic conditions, taste, odor or discoloration in a potable water system shall not be introduced into, or utilized in, such systems.

3.8.6 **Cross-connection control.** Cross connections shall be prohibited, except where approved protective devices are installed.

3.8.6.1 **Private water supplies.** Cross connections between a private water supply and a potable public supply shall be prohibited.

3.8.7 **Stop-and-waste valves prohibited.** Combination stop-and-waste valves or cocks shall not be installed underground.

3.8.8 **Identification of potable and nonpotable water.** In all buildings where two or more water distribution systems, one potable water and the other nonpotable water, are installed, each system shall be identified either by color marking or metal tags in accordance with Sections 3.8.8.1 through 3.8.8.3.

3.8.8.1 **Information.** Pipe identification shall include the contents of the piping system and an arrow indicating the direction of flow. Hazardous piping systems shall also contain information addressing the nature of the hazard. Pipe identification shall be repeated at maximum intervals of 7 m and at each point where the piping passes through a wall, floor or roof. Lettering shall be readily observable within the room or space the piping is located.

3.8.8.2 **Color.** The color of the pipe identification shall be discernable and consistent throughout the building.

3.8.8.3 **Size.** The size of the background color field and lettering shall comply with Table 3.8.8.3.

TABLE 3.8.8.3
SIZE OF PIPE IDENTIFICATION

PIPE DIAMETER (mm)	LENGTH OF BACKGROUND COLOR FIELD (mm)	SIZE OF LETTERS (mm)
20 to 32	200	13
40 to 50	200	19
65 to 150	300	32
200 to 250	600	64
over 250	800	90

3.8.9 **Reutilization prohibited.** Water utilized for the cooling of equipment or other processes shall not be returned to the potable water system. Such water shall be discharged into a drainage system through an air gap or shall be utilized for nonpotable purposes.

3.8.10 **Reuse of piping.** Piping that has been utilized for any purpose other than conveying potable water shall not be utilized for conveying potable water.

3.8.11 **Painting of water tanks.** The interior surface of a potable water tank shall not be lined, painted or repaired with any material that changes the taste, odor, color or potability of the water supply when the tank is placed in, or returned to, service.

3.8.12 **Pumps and other appliances.** Water pumps, filters, softeners, tanks and all other devices that handle or treat potable water shall be protected against contamination.

3.8.13 **Backflow protection.** Means of protection against backflow shall be provided in accordance with Sections 3.8.13.1 through 3.8.13.9.

3.8.13.1 **Air gap.** The minimum required air gap shall be measured vertically from the lowest end of a potable water outlet to the flood level rim of the fixture or receptacle into which such potable water outlet discharges. Air gaps shall comply with ASME A112.1.2 and air gap fittings shall comply with ASME A112.1.3.

3.8.13.2 **Reduced pressure principle backflow preventers.** Reduced pressure principle backflow preventers shall conform to ASSE 1013, AWWA C511 or CAN/CSA-B64.4. Reduced pressure detector assembly backflow preventers shall conform to ASSE 1047. These devices shall be permitted to be installed where subject to continuous pressure conditions. The relief opening shall discharge by air gap and shall be prevented from being submerged.

3.8.13.3 **Backflow preventer with intermediate atmospheric vent.** Backflow preventers with intermediate atmospheric vents shall conform to ASSE 1012 or CAN/CSA-B64.4. These devices shall be permitted to be installed where subject to continuous pressure conditions. The relief opening shall discharge by air gap and shall be prevented from being submerged.

3.8.13.4 **Barometric loop.** Barometric loops shall precede the point of connection and shall extend vertically to a height of 10 m. A barometric loop shall only be utilized as an atmospheric-type or pressure-type vacuum breaker.

3.8.13.5 **Pressure-type vacuum breakers.** Pressure-type vacuum breakers shall conform equivalent to ASSE 1020 and spillproof vacuum breakers shall comply with to ASSE 1056. These devices are designed for installation under continuous pressure conditions when the critical level is installed at the required height. Pressure-type vacuum breakers shall not be installed in locations where spillage could cause damage to the structure.

3.8.13.6 **Atmospheric-type vacuum breakers.** Pipe-applied atmospheric-type vacuum breakers shall conform to ASSE 1001 or CAN/CSA-B64.1.1. Hose-connection vacuum breakers shall conform to ASSE 1011, ASSE 1019, ASSE 1035, ASSE 1052, CAN/CSA B64.2, CAN/CSA B64.2.2 or CSA B64.7. These devices shall operate under normal atmospheric pressure when the critical level is installed at the required height.

3.8.13.7 **Double check-valve assemblies.** Double check-valve assemblies shall conform to ASSE 1015 or AWWA C510. Double-detector check-valve assemblies shall conform to ASSE 1048. These devices shall be capable of operating under continuous pressure conditions.

3.8.13.8 **Spillproof vacuum breakers.** Spillproof vacuum breakers (SVB) shall conform to ASSE 1056. These devices are designed for installation under continuous-pressure conditions when the critical level is installed at the required height.

3.8.13.9 **Chemical dispenser backflow devices.** Backflow devices for chemical dispensers shall comply with ASSE 1055 or shall be equipped with an air gap fitting.

3.8.14 **Location of backflow preventers.** Access shall be provided to backflow preventers as specified by the installation instructions of the approved manufacturer.

3.8.14.1 **Outdoor enclosures for backflow prevention devices.** Outdoor enclosures for backflow prevention devices shall comply with ASSE 1060.

3.8.15 **Protection of potable water outlets.** All potable water openings and outlets shall be protected against backflow in accordance with Section 3.8.15.1, 3.8.15.2, 3.8.15.3, 3.8.15.4, 3.8.15.4.1, 3.8.15.4.2 or 3.8.15.4.3.

3.8.15.1 **Protection by air gap.** Openings and outlets shall be protected by an air gap between the opening and the fixture flood level rim as specified in Table 3.8.15.1. Openings and outlets equipped for hose connection shall be protected by means other than an air gap.

TABLE 3.8.15.1
MINIMUM REQUIRED AIR GAPS

FIXTURE	MINIMUM AIR GAP	
	Away from a wall [a] (mm)	Close to a wall (mm)
Lavatories (wash-basin) and other fixtures with effective opening not greater than 15 mm in diameter	25	40
Sink, laundry trays, gooseneck back faucets and other fixtures with effective openings not greater than 20 mm in diameter	40	65
Over-rim bath fillers and other fixtures with effective openings not greater than 25 mm in diameter	50	75
Drinking water fountains, single orifice not greater than 11 mm in diameter or multiple orifices with a total area of 95 mm^2 (area of circle 11 mm in diameter)	25	40
Effective openings greater than 25 mm	Two times the diameter of the effective opening	Three times the diameter of the effective opening

a. Applicable where walls or obstructions are spaced from the nearest inside-edge of the spout opening a distance greater than three times the diameter of the effective opening for a single wall, or a distance greater than four times the diameter of the effective opening for two intersecting walls.

3.8.15.2 **Protection by a reduced pressure principle backflow preventer.** Openings and outlets shall be protected by a reduced pressure principle backflow preventer.

3.8.15.3 **Protection by a backflow preventer with intermediate atmospheric vent.** Openings and outlets shall be protected by a backflow preventer with an intermediate atmospheric vent.

3.8.15.4 **Protection by a vacuum breaker.** Openings and outlets shall be protected by atmospheric-type or pressure-type vacuum breakers. The critical level of the vacuum breaker shall be set a minimum of 0.15 m above the flood level rim of the fixture or device. Fill valves shall be set in accordance with Section 2.25.3.1. Vacuum breakers shall not be installed under exhaust hoods or similar locations that will contain toxic fumes or vapors. Pipe-applied vacuum breakers shall be installed not less than 0.15 m above the flood level rim of the fixture, receptor or device served.

3.8.15.4.1 **Deck-mounted and integral vacuum breakers.** Approved deck-mounted or equipment-mounted vacuum breakers and faucets with integral atmospheric or spillproof vacuum breakers shall be installed in accordance with the manufacturer's instructions and the requirements for labeling with the critical level not less than 25 mm above the flood level rim.

3.8.15.4.2 Hose connections. Sillcocks, hose bibbs, wall hydrants and other openings with a hose connection shall be protected by an atmospheric-type or pressure-type vacuum breaker or a permanently attached hose connection vacuum breaker.

Exceptions:

1. This section shall not apply to water heater and boiler drain valves that are provided with hose connection threads and that are intended only for tank or vessel draining.
2. This section shall not apply to water supply valves intended for connection of clothes washing machines where backflow prevention is otherwise provided or is integral with the machine.

3.8.16 Connections to the potable water system. Connections to the potable water system shall conform to Sections 3.8.16.1 through 3.8.16.9.

3.8.16.1 Beverage dispensers. The water supply connection to carbonated beverage dispensers shall be protected against backflow by a backflow preventer conforming to ASSE 1022 or by an air gap. The backflow preventer device and the piping downstream there from shall not be affected by carbon dioxide gas.

3.8.16.2 Connections to boilers. The potable supply to the boiler shall be equipped with a backflow preventer with an intermediate atmospheric vent complying with ASSE 1012 or CAN/CSA B64.3. Where conditioning chemicals are introduced into the system, the potable water connection shall be protected by an air gap or a reduced pressure principle backflow preventer, complying with ASSE 1013, CAN/CSA B64.4 or AWWA C511.

3.8.16.3 Heat exchangers. Heat exchangers utilizing an essentially toxic transfer fluid shall be separated from the potable water by double-wall construction. An air gap open to the atmosphere shall be provided between the two walls. Heat exchangers utilizing an essentially nontoxic transfer fluid shall be permitted to be of single-wall construction.

3.8.16.4 Connections to automatic fire sprinkler systems and standpipe systems. The potable water supply to automatic fire sprinkler and standpipe systems shall be protected against backflow by a double check-valve assembly or a reduced pressure principle backflow preventer.

Exceptions:

1. Where systems are installed as a portion of the water distribution system in accordance with these requirements of SBC 701 and are not provided with a Civil Defense department connection, isolation of the water supply system shall not be required.
2. Isolation of the water distribution system is not required for deluge, reaction or dry pipe systems.

3.8.16.4.1 Additives or nonpotable source. Where systems under continuous pressure contain chemical additives or antifreeze, or where systems are connected to a nonpotable secondary water supply, the potable water supply shall be protected against backflow by a reduced pressure principle backflow preventer. Where chemical additives or antifreeze are added to only a portion of an automatic fire sprinkler or standpipe system, the reduced pressure principle backflow preventer shall be permitted to be located so as to isolate that portion of the system. Where systems are not under continuous pressure, the potable water supply shall be protected against backflow by an air gap or a pipe applied atmospheric vacuum breaker conforming to ASSE 1001 or CAN/CSA B64.1.1.

3.8.16.5 Connections to lawn irrigation systems. The potable water supply to lawn irrigation systems shall be protected against backflow by an atmospheric-type vacuum breaker, a pressure-type vacuum breaker or a reduced pressure principle

backflow preventer. A valve shall not be installed downstream from an atmospheric vacuum breaker. Where chemicals are introduced into the system, the potable water supply shall be protected against backflow by a reduced pressure principle backflow preventer.

3.8.16.6 **Connections subject to backpressure.** Where a potable water connection is made to a nonpotable line, fixture, tank, vat, pump or other equipment subject to back-pressure, the potable water connection shall be protected by a reduced pressure principle backflow preventer.

3.8.16.7 **Chemical dispensers.** Where chemical dispensers connect to the potable water distribution system, the water supply system shall be protected against backflow in accordance with Section 3.8.13.1, 3.8.13.2, 3.8.13.5, 3.8.13.6, 3.8.13.8 or 3.8.13.9.

3.8.16.8 **Portable cleaning equipment.** Where the portable cleaning equipment connects to the water distribution system, the water supply system shall be protected against backflow in accordance with Section 3.8.13.1, 3.8.13.2, 3.8.13.3, 3.8.13.7 or 3.8.13.8.

3.8.16.9 **Dental pump equipment.** Where dental pumping equipment connects to the water distribution system, the water supply system shall be protected against backflow in accordance with Section 3.8.13.1, 3.8.13.2, 3.8.13.5, 3.8.13.6 or 3.8.13.8.

3.8.17 **Protection of individual water supplies.** An individual water supply shall be located and constructed so as to be safeguarded against contamination in accordance with Sections 3.8.17.1 through 3.8.17.8.

3.8.17.1 **Well locations.** A potable ground water source or pump suction line shall not be located closer to potential sources of contamination than the distances shown in Table 3.8.17.1. In the event the underlying rock structure is limestone or fragmented shale, the local Water Directorate shall be consulted on well site location. The distances in Table 3.8.17.1 constitute minimum separation and shall be increased in areas of creviced rock or limestone, or where the direction of movement of the ground water is from sources of contamination toward the well.

TABLE 3.8.17.1
DISTANCE FROM CONTAMINATION TO PRIVATE WATER SUPPLIES AND PUMP SUCTION LINES

SOURCE OF CONTAMINATION	DISTANCE (m)
Barnyard	50
Farm silo	20
Pasture	50
Pumphouse floor drain of cast iron draining to ground surface	5
Seepage pits	30
Septic tank	30
Sewer	10
Subsurface disposal fields	20
Subsurface pits	20

3.8.17.2 **Elevation.** Well sites shall be positively drained and shall be at higher elevations than potential sources of contamination.

3.8.17.3 **Depth.** Private potable well supplies shall not be developed from a water table less

than the depth as required by the local Water Directorate below the ground surface.

3.8.17.4 **Water-tight casings.** Each well shall be provided with a water-tight casing to a minimum distance of that is required by the local Water Directorate below the ground surface. All casings shall extend at least 150 mm above the well platform. The casing shall be large enough to permit installation of a separate drop pipe. Casings shall be sealed at the bottom in an impermeable stratum or extend several feet into the water-bearing stratum.

3.8.17.5 **Drilled or driven well casings.** Drilled or driven well casings shall be of steel or other approved material. Where drilled wells extend into a rock formation, the well casing shall extend to and set firmly in the formation. The annular space between the earth and the outside of the casing shall be filled with cement grout to a minimum distance of that as requested by the local Water Directorate below the ground surface. In an instance of casing to rock installation, the grout shall extend to the rock surface.

3.8.17.6 **Dug or bored well casings.** Dug or bored well casings shall be of water-tight concrete, tile, or galvanized or corrugated metal pipe to a minimum distance of that as required by the local Water Directorate below the ground surface. Where the water table is more than as required by the local Water Directorate below the ground surface, the water-tight casing shall extend below the table surface. Well casings for dug wells or bored wells constructed with sections of concrete, tile, or galvanized or corrugated metal pipe shall be surrounded by 150 mm of grout poured into the hole between the outside of the casing and the ground to a minimum depth of distance that as required by the local Water Directorate.

3.8.17.7 **Cover.** Every potable water well shall be equipped with an overlapping water-tight cover at the top of the well casing or pipe sleeve such that contaminated water or other substances are prevented from entering the well through the annular opening at the top of the well casing, wall or pipe sleeve. Covers shall extend downward at least 50 mm over the outside of the well casing or wall. A dug well cover shall be provided with a pipe sleeve permitting the withdrawal of the pump suction pipe, cylinder or jet body without disturbing the cover. Where pump sections or discharge pipes enter or leave a well through the side of the casing, the circle of contact shall be water tight.

3.8.17.8 **Drainage.** All potable water wells and springs shall be constructed such that surface drainage will be diverted away from the well or spring.

SECTION 3.9
HEALTH CARE PLUMBING

3.9.1 **Scope.** This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to the requirements of this section in addition to the other requirements of SBC 701. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes, homes for the aged, orphanages, infirmaries, first aid stations, psychiatric facilities, clinics, professional offices of dentists and doctors, mortuaries, educational facilities, surgery, dentistry, research and testing laboratories, establishments manufacturing pharmaceutical drugs and medicines, and other structures with similar apparatus and equipment classified as plumbing.

3.9.2 **Water service.** All hospitals shall have two water service pipes installed in such a manner so as to minimize the potential for an interruption of the supply of water in the event of a water main or water service pipe failure. In addition, there shall be

another approved water source or water storage that is enough for the hospital demand in the event of water main line supply to the hospital is shut-off or diverted.

3.9.3 **Hot water.** Hot water shall be provided to supply all of the hospital fixture, kitchen and laundry requirements. Special fixtures and equipment shall have hot water supplied at a temperature specified by the manufacturer. The hot water system shall be installed in accordance with Section 3.7.

3.9.4 **Vacuum breaker installation.** Vacuum breakers shall be installed a minimum of 0.15 m above the flood level rim of the fixture or device in accordance with Section 3.8. The flood level rim of hose connections shall be the maximum height at which any hose is utilized.

3.9.5 **Prohibited water closet and clinical sink supply.** Jet- or water-supplied orifices, except those supplied by the flush connections, shall not be located in or connected with a water closet bowl or clinical sink. This section shall not prohibit an approved bidet installation.

3.9.6 **Clinical, hydrotherapeutic and radiological equipment.** All clinical, hydrotherapeutic, radiological or any equipment that is supplied with water or that discharges to the waste system shall conform to the requirements of this section and Section 3.8.

3.9.7 **Condensate drain trap seal.** A water supply shall be provided for cleaning, flushing and resealing the condensate trap, and the trap shall discharge through an air gap in accordance with Section 3.8.

3.9.8 **Valve leakage diverter.** Each water sterilizer filled with water through directly connected piping shall be equipped with an approved leakage diverter or bleed line on the water supply control valve to indicate and conduct any leakage of unsterile water away from the sterile zone.

SECTION 3.10
DISINFECTION OF POTABLE WATER SYSTEM

3.10.1 **General.** New or repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be as described in this section. This requirement shall apply to “on-site” or “in-plant” fabrication of a system or to a modular portion of a system.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.
3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

SECTION 3.11
DRINKING WATER TREATMENT UNITS

3.11.1 **Design.** Drinking water treatment units shall meet the requirements of NSF 42, NSF 44, NSF 53 or NSF 62.

3.11.2 **Reverse osmosis systems.** The discharge from a reverse osmosis drinking water treatment unit shall enter the drainage system through an air gap or an air gap device that meets the requirements of NSF 58.

3.11.3 **Connection tubing.** The tubing to and from drinking water treatment units shall be of a size and material as recommended by the manufacturer. The tubing shall comply with NSF 14, NSF 42, NSF 44, NSF 53, NSF 58 or NSF 61.

SECTION 3.12
SOLAR SYSTEMS

3.12.1 **Solar systems.** The construction, installation, alterations and repair of systems, equipment and appliances intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating shall be in accordance with the Saudi Building Code Mechanical requirement SBC 501.

SECTION 3.13
TEMPERATURE CONTROL DEVICES AND VALVES

3.13.1 **Temperature-actuated mixing valves.** Temperature actuated mixing valves, which are installed to reduce water temperatures to defined limits, shall comply with ASSE 1017.

CHAPTER 4
SANITARY DRAINAGE SYSTEMS

SECTION 4.1
GENERAL

4.1.1 **Scope**.The provisions of this chapter shall govern the materials, design, construction and installation of sanitary drainage systems.

4.1.2 **Sewer required**. Every building in which plumbing fixtures are installed and all premises having drainage piping shall be connected to a public sewer, where available, or an approved private sewage disposal system in accordance with Chapter 7 of these requirements SBC 701.

4.1.3 **Separate sewer connection**. Every building having plumbing fixtures installed and intended for human habitation, occupancy or use on premises abutting on a street, alley or easement in which there is a public sewer shall have a separate connection with the sewer. Where located on the same lot, multiple buildings shall not be prohibited from connecting to a common building sewer that connects to the public sewer.

4.1.4 **Sewage treatment**. Sewage or other waste from a plumbing system that is deleterious to surface or subsurface waters shall not be discharged into the ground or into any waterway unless it has first been rendered innocuous through subjection to an approved form of treatment.

4.1.5 **Damage to drainage system or public sewer.** Wastes detrimental to the public sewer system or to the functioning of the sewage-treatment plant shall be treated and disposed of in accordance with Section 4.19 as directed by the code official.

4.1.6 **Tests**. The sanitary drainage system shall be tested in accordance with Section 1.12.

4.1.7 **Connections**. Direct connection of a steam exhaust, blowoff or drip pipe shall not be made with the building drainage system. Wastewater when discharged into the building drainage system shall be at a temperature not higher than 60°C. When higher temperatures exist, approved cooling methods shall be provided.

4.1.8 **Engineered systems**. Engineered sanitary drainage systems shall conform to the provisions of Sections 4.14.

4.1.9 **Drainage piping in food service areas**. Exposed soil or waste piping shall not be installed above any working, storage or eating surfaces in food service establishments.

SECTION 4.2
MATERIALS

4.2.1 **Above-ground sanitary drainage and vent pipe.** Above-ground soil, waste and vent pipe shall conform to one of the standards listed in Table 4.2.1.

4.2.2 **Underground building sanitary drainage and vent pipe**. Underground building sanitary drainage and vent pipe shall conform to one of the standards listed in

Table 4.2.2.

4.2.3 **Building sewer pipe**. Building sewer pipe shall conform to one of the standards listed in Table 4.2.3.

4.2.4 **Fittings.** Pipe fittings shall be approved for installation with the piping material installed and shall conform to the respective pipe standards or one of the standards listed in Table 4.2.4.

4.2.5 **Chemical waste system**. A chemical waste system shall be completely separated from the sanitary drainage system. The chemical waste shall be treated in accordance with Section 4.17.2 before discharging to the sanitary drainage system. Separate drainage systems for chemical wastes and vent pipes shall be of an approved material that is resistant to corrosion and degradation for the concentrations of chemicals involved.

4.2.6 **Lead bends and traps.** Lead bends and traps shall not be less than 3 mm wall thickness.

TABLE 4.2.1
ABOVE-GROUND DRAINAGE AND VENT PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM F 628; CSA B181.1
Brass pipe	ASTM B 43
Cast-iron pipe	SASO 882/1994
Coextruded composite ABS DWV schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite ABS DWV schedule 40 IPS pipe (cellular core)	ASTM F 1488
Coextruded composite PVC DWV schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite PVC DWV schedule 40 IPS pipe (cellular core)	ASTM F 1488
Coextruded composite PVC IPS-DR, PS140, PS200 DWV	ASTM F 1488
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, L, M or DWV)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 306
Galvanized steel pipe	ASTM A 53
Glass pipe	ASTM C 1053
Polyolefin pipe	CAN/CSA-B181.3
Polyvinyl chloride (PVC) plastic pipe (Type DWV)	SASO 1209/1997
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1

TABLE 4.2.2
UNDERGROUND BUILDING DRAINAGE AND VENT PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM F 628; CSA B181.1
Cast-iron pipe	SASO 882/1994
Coextruded composite ABS DWV schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite ABS DWV schedule 40 IPS pipe (cellular core)	ASTM F 1488
Coextruded composite PVC DWV schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite PVC DWV schedule 40 IPS pipe (cellular core)	ASTM F 1488
Coextruded composite PVC IPS-DR, PS140, PS200DWV	ASTM F 1488
Copper or copper alloy tubing (Type K, L, M or DWV)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 306
Polyolefin pipe	CAN/CSA-B181.3
Polyvinyl chloride (PVC) plastic pipe (Type DWV)	ASTM D 2665; ASTM D 2949; ASTM F 891; CSA-B181.2
Stainless steel drainage systems, Type 316L	ASME A112.3.1

TABLE 4.2.3
BUILDING SEWER PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM D 2751; CSA F 628
Cast-iron pipe	SASO 882/1994
Coextruded composite ABS DWV schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite ABS DWV schedule 40 IPS pipe (cellular core)	ASTM F 1488
Coextruded composite PVC DWV schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite PVC DWV schedule 40 IPS pipe (cellular core)	ASTM F 1488
Coextruded composite PVC IPS-DR, PS140, PS200, DWV	ASTM F 1488
Coextruded composite ABS sewer and drain DR-PS in PS35, PS50,PS100, PS140, PS200	ASTM F 1488
Coextruded composite PVC sewer and drain DR-PS in PS35, PS50, PS100, PS140, PS200	ASTM F 1488
Concrete pipe	ASTM C14; ASTM C76; CAN/CSA A257.1M; CAN/CSA A257.2M
Copper or copper-alloy tubing (Type K or L)	ASTM B 75; ASTM B 88; ASTM B 251
Polyethylene (PE) plastic pipe (SDR-PR)	ASTM F 714
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100)	ASTM D 2665; ASTM D 2949; ASTM D 3034; ASTM F 891; CSA B182.2; CAN/CSA B182.4
Stainless steel drainage systems, types 304 and 316L	ASME A112.3.1
Vitrified clay pipe	SASO 236/1995

TABLE 4.2.4
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 3311; CSA B181.1; ASTM D 2661
Cast iron	ASME B 16.4; ASME B 16.12; ASTM A 74; ASTM A 888; CISPI 301
Coextruded composite ABS DWV schedule 40 IPS pipe (solid or cellular core)	ASTM D 2661; ASTM D 3311; ASTM F 628
Coextruded composite PVC DWV schedule 40 IPS-DR, PS140, PS200 (solid or cellular core)	ASTM D 2665; ASTM D 3311; ASTM F 891
Coextruded composite ABS sewer and drain DR-PS in PS35, PS50, PS100, PS140, PS200	ASTM D 2751
Coextruded composite PVC sewer and drain DR-PS in PS35, PS50, PS100, PS140, PS200	ASTM D 3034
Copper or copper alloy	ASME B 16.15; ASME B 16.18; ASME B16.22; ASME B 16.23; ASME B 16.26; ASME B 16.29
Glass	ASTM C 1053
Gray iron and ductile iron	AWWA C 110
Malleable iron	ASME B 16.3
Polyvinyl chloride (PVC) Plastic	ASTM D 3311; ASTM D2665; ASTM F 1866
Stainless steel drainage systems, Types 304 and 316L	ASME A 112.3.1
Steel	ASME B 16.9; ASME B16.11; ASME B16.28

SECTION 4.3
BUILDING SEWER

4.3.1 **Building sewer pipe near the water service**. Where the building sewer is installed within 1.5 m of the water service, as provided for in Section 3.3.2, the building sewer pipe shall conform to one of the standards for ABS plastic pipe, cast-iron pipe, copper or copper-alloy tubing, or PVC plastic pipe listed in Table 4.2.3.

4.3.2 **Drainage pipe in filled ground**. Where a building sewer or building drain is installed on filled or unstable ground, the drainage pipe shall conform to one of the standards for ABS plastic pipe, cast-iron pipe, copper or copper-alloy tubing, or PVC plastic pipe listed in Table 4.2.3.

4.3.3 **Sanitary and storm sewers.** Where separate systems of sanitary drainage and storm drainage are installed in the same property, the sanitary and storm building sewers or drains shall be permitted to be laid side by side in one trench.

4.3.4 **Existing building sewers and drains**. Existing building sewers and drains shall connect with new building sewer and drainage systems only where found by examination and test to conform to the new system in quality of material. The code official shall notify the owner to make the changes necessary to conform to these requirements SBC 701.

4.3.5 Cleanouts and inspection chambers on building sewers. Cleanouts and inspection chambers on building sewers shall be located as set forth in Section 4.8.

SECTION 4.4
DRAINAGE PIPING INSTALLATION

4.4.1 Slope of horizontal drainage piping. Horizontal drainage piping shall be installed in uniform alignment at uniform slopes. The minimum slope of a horizontal drainage pipe shall be in accordance with Table 4.4.1.

TABLE 4.4.1
SLOPE OF HORIZONTAL DRAINAGE PIPE

SIZE (mm)	**MINIMUM SLOPE** (%)
65 or less	2
75 to 150	1
200 or larger	0.5

4.4.2 Change in size. The size of the drainage piping shall not be reduced in size in the direction of the flow.

4.4.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 4.11.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack.

4.4.4 Future fixtures. Drainage piping for future fixtures shall terminate with an approved cap or plug.

4.4.5 Dead ends. In the installation or removal of any part of a drainage system, dead ends shall be prohibited. Cleanout extensions and approved future fixture drainage piping shall not be considered as dead ends.

SECTION 4.5
JOINTS

4.5.1 General. This section contains provisions applicable tojoints specific to sanitary drainage piping.

4.5.2 ABS plastic joints. Joints between ABS plastic pipe or fittings shall comply with Sections 4.5.2.1 through 4.5.2.3.

4.5.2.1 Mechanical joints. Mechanical joints on drainage pipes shall be made with an elastomeric seal conforming to ASTM C1173, ASTM D3212 or CAN/CSA-B602. Mechanical joints shall be installed only in underground systems unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

4.5.2.2 Solvent cementing. Joint surfaces shall be clean and free from moisture. Solvent cement that conforms to ASTM D 2235 or CSA B181.1 shall be applied to all joint

surfaces.The joint shall be made while the cement is wet. Joints shall be made in accordance with ASTM D 2235, ASTM D 266, ASTM F 628 or CSAB 181.1. Solvent-cement joints shall be permitted above or below ground.

4.5.2.3 **Threaded joints.** Threads shall conform to ASME B1.20.1. Schedule 80, or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

4.5.3 **Brass joints.** Joints between brass pipe or fittings shall comply with Sections 4.5.3.1 through 4.5.3.4.

4.5.3.1 **Brazed joints.** All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

4.5.3.2 **Mechanical joints .** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

4.5.3.3 **Threaded joints.** Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

4.5.3.4 **Welded joints.** All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

4.5.4 **Cast iron joints.** Joints between cast-iron pipe or fittings shall comply with Sections 4.5.4.1 through 4.5.4.3.

4.5.4.1 **Caulked joints.** Joints for hub and spigot pipe shall be firmly packed with oakum or hemp. Molten lead shall be poured in one operation to a depth of not less than 25 mm. The lead shall not recede more than 3 mm below the rim of the hub and shall be caulked tight. Paint, varnish or other coatings shall not be permitted on the jointing material until after the joint has been tested and approved. Lead shall be run in one pouring and shall be caulked tight. Acid-resistant rope and acidproof cement shall be permitted.

4.5.4.2 **Compression gasket joints.** Compression gaskets for hub and spigot pipe and fittings shall conform to ASTM C 564. Gaskets shall be compressed when the pipe is fully inserted.

4.5.4.3 **Mechanical joint coupling.** Mechanical joint couplings for hubless pipe and fittings shall comply with CISPI 310 or ASTM C 1277. The elastomeric sealing sleeve shall conform to ASTM C 564 or CAN/CSA B602, and shall be provided with a center stop. Mechanical joint couplings shall be installed in accordance with the manufacturer's installation instructions.

4.5.5 **Concrete joints.** Joints between concrete pipe and fittings shall be made with an elastomeric seal conforming to ASTM C 443, ASTM C 1173, CAN/CSA A257.3M or CAN/CSA-B602.

4.5.6 **Coextruded composite ABS pipe, joints.** Joints between coextruded composite pipe with an ABS outer layer or ABS fittings shall comply with Sections 4.5.6.1 and 4.5.6.2.

4.5.6.1 **Mechanical joints.** Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CAN/CSA B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

4.5.6.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. Solvent cement that conforms to ASTM D 2235 or CSA-B181.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet. Joints shall be made in accordance with ASTM D 2235, ASTM D 2661, ASTM F 628 or

CSA B181.1. Solvent-cement joints shall be permitted above or below ground.

4.5.7 **Coextruded composite PVC pipe joints.** Joints between coextruded composite pipe with a PVC outer layer or PVC fittings shall comply with Sections 4.5.7.1 and 4.5.7.2.

4.5.7.1 **Mechanical joints.** Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM D 3212. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's in structions.

4.5.7.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656, shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA B137.3, CSA B181.2 or CSA B182.1, shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

4.5.8 **Copper pipe joints.** Joints between copper or copper-alloy pipe or fittings shall comply with Sections 4.5.8.1 through 4.5.8.5.

4.5.8.1 **Brazed joints.** All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

4.5.8.2 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

4.5.8.3 **Soldered joints.** Solder joints shall be made in accordance with the methods of ASTM B 828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B 813, shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32.

4.5.8.4 **Threaded joints.** Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

4.5.8.5 **Welded joints.** All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

4.5.9 **Copper tubing joints.** Joints between copper or copper-alloy tubing or fittings shall comply with Sections 4.5.9.1 through 4.5.9.3.

4.5.9.1 **Brazed joints.** All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

4.5.9.2 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

4.5.9.3 **Soldered joints.** Solder joints shall be made in accordance with the methods of ASTM B 828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B 813, shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32.

4.5.10 **Borosilicate glass joints.** Glass-to-glass connections shall be made with a bolted compression-type stainless steel (300 series) coupling with contoured acid-resistant elastomeric compression ring and a fluorocarbon polymer inner seal ring; or with caulked joints in accordance with Section 4.5.10.1.

4.5.10.1 **Caulked joints.** Every lead-caulked joint for hub and spigot soil pipe shall be firmly packed with oakum or hemp and filled with molten lead not less than 25 mm deep and not to extend more than 3 mm below the rim of the hub. Paint, varnish or other coatings shall not be permitted on the jointing material until after the joint

has been tested and approved. Lead shall be run in one pouring and shall be caulked tight. Acid-resistant rope and acidproof cement shall be permitted.

4.5.11 **Steel joints.** Joints between galvanized steel pipe or fittings shall comply with Sections 4.5.11.1 and 4.5.11.2.

4.5.11.1 **Threaded joints.** Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

4.5.11.2 **Mechanical joints.** Joints shall be made with an approved elastomeric seal. Mechanical joints shall be installed in accordance with the manufacturer's instructions.

4.5.12 **Lead joints.** Joints between lead pipe or fittings shall comply with Sections 4.5.12.1 and 4.5.12.2.

4.5.12.1 **Burned joints.** Burned joints shall be uniformly fused together into one continuous piece. The thickness of the joint shall be at least as thick as the lead being joined. The filler metal shall be of the same material as the pipe.

4.5.12.2 **Wiped joints**. Joints shall be fully wiped, with an exposed surface on each side of the joint not less than 20 mm. The joint shall be at least 10 mm thick at the thickest point.

4.5.13 **PVC plastic joints.** Joints between PVC plastic pipe or fittings shall comply with Sections 4.5.13.1 through 4.5.13.3.

4.5.13.1 **Mechanical joints.** Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D3212 or CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

4.5.13.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656, shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA B137.3, CSA B181.2 or CSA B182.1, shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

4.5.13.3 **Threaded joints.** Threads shall conform to ASME B1.20.1 Schedule 80, or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

4.5.14 **Vitrified clay joints.** Joints between vitrified clay pipe or fittings shall be made with an elastomeric seal conforming to ASTM C 425, ASTM C 1173 or CAN/CSA-B602.

4.5.15 **Joints between different materials.** Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type conforming to ASTM C 1173, ASTM C 1460 or ASTM C 1461. Connectors and adapters shall be approved for the application and such joints shall have an elastomeric seal conforming to ASTM C 425, ASTM C 443, ASTM C 564, ASTM C 1440, ASTM D 1869, ASTM F 477, CAN/CSA A257.3M or CAN/CSA B602, or as required in Sections 4.5.15.1 through 4.5.15.5. Joints between glass pipe and other types of materials shall be made with adapters having a TFE seal. Joints shall be installed in accordance with the manufacturer's instructions.

4.5.15.1 **Copper or copper-alloy tubing to cast-iron hub pipe.** Joints between copper or copper-alloy tubing and cast-iron hub pipe shall be made with a brass ferrule or compression joint. The copper or copper-alloy tubing shall be soldered to the

ferrule in an approved manner, and the ferrule shall be joined to the cast-iron hub by a caulked joint or a mechanical compression joint.

4.5.15.2 **Copper or copper-alloy tubing to galvanized steel pipe.** Joints between copper or copper-alloy tubing and galvanized steel pipe shall be made with a brass converter fitting or dielectric fitting.The copper tubing shall be soldered to the fitting in an approved manner, and the fitting shall be screwed to the threaded pipe.

4.5.15.3 **Cast-iron pipe to galvanized steel or brass pipe.** Joints between cast-iron and galvanized steel or brass pipe shall be made by either caulked or threaded joints or with an approved adapter fitting.

4.5.15.4 **Plastic pipe or tubing to other piping material.** Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting. Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a mechanical compression joint.

4.5.15.5 **Lead pipe to other piping material.** Joints between lead pipe and other piping material shall be made by a wiped joint to a caulking ferrule, soldering nipple, or bushing or shall be made with an approved adapter fitting.

4.5.15.6 **Borosilicate glass to other materials.** Joints between glass pipe and other types of materials shall be made with adapters having a TFE seal and shall be installed in accordance with the manufacturer's instructions.

4.5.15.7 **Stainless steel drainage systems to other materials.** Joints between stainless steel drainage systems and other piping materials shall be made with approved mechanical couplings.

4.5.16 **Drainage slip joints.** Slip joints shall comply with Section 2.5.8.

4.5.17 **Caulking ferrules.** Ferrules shall be of red brass and shall be in accordance with Table 4.5.17.

TABLE 4.5.17
CAULKING FERRULE SPECIFICATIONS

PIPE SIZES (mm)	INSIDE DIAMETER (mm)	LENGTH (mm)	MINIMUM WEIGHT
50	55	115	450
75	85	115	800
100	115	115	1100

4.5.18 **Soldering bushings.** Soldering bushings shall be of red brass and shall be in accordance with Table 4.5.18.

TABLE 4.5.18
SOLDERING BUSHING SPECIFICATIONS

PIPE SIZES (mm)	MINIMUM WEIGHT EACH (g)
32	170
40	225
50	400
65	625
75	900
100	1600

SECTION 4.6
CONNECTIONS BETWEEN DRAINAGE PIPING AND FITTINGS

4.6.1 **Connections and changes in direction.** All connections and changes in direction of the sanitary drainage system shall be made with approved drainage fittings. Connections between drainage piping and fixtures shall conform to Section 2.5.

4.6.2 **Obstructions.** The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.

4.6.3 **Installation of fittings.** Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with Table 4.6.3. Change in direction by combination fittings, side inlets or increasers shall be installed in accordance with Table 4.6.3 based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of back-to-back water closets and fixtures or appliances with pumping action discharge.

Exception: Back-to-back water closet connections to double sanitary tees shall be permitted where the horizontal developed length between the outlet of the water closet and the connection to the double sanitary tee pattern is 0.45 m or greater.

TABLE 4.6.3
FITTINGS FOR CHANGE IN DIRECTION

TYPE OF FITTING PATTERN	CHANGE IN DIRECTION		
	Horizontal to vertical	Vertical to horizontal	Horizontal to horizontal
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	X[a]	X[a]
Short sweep	X	X[a,b]	X[a]
Long sweep	X	X	X
Sanitary tee	X[c]	—	—
Wye	X	X	X
Combination wye and eighth bend	X	X	X

a. The fittings shall only be permitted for a 50 mm or smaller fixture drain.
b. 75 mm or larger.
c. For a limitation on double sanitary tees, see Section 4.6.3.

SECTION 4.7
PROHIBITED JOINTS AND CONNECTIONS

4.7.1 **Prohibited joints.** The following types of joints and connections shall be prohibited:

1. Cement or concrete joints.
2. Mastic or hot-pour bituminous joints.
3. Joints made with fittings not approved for the specific installation.
4. Joints between different diameter pipes made with elastomeric rolling O-rings.

5. Solvent-cement joints between different types of plastic pipe.
6. Saddle-type fittings.

SECTION 4.8
CLEANOUTS AND INSPECTION CHAMBERS

4.8.1 **Scope.** This section shall govern the size, location, installation and maintenance of drainage pipe cleanouts and inspection chambers.

4.8.2 **Plugs and covers.**

4.8.2.1 **Cleanout plugs.** Cleanout plugs shall be brass or plastic, or other approved materials. Brass cleanout plugs shall be utilized with metallic drain, waste and vent piping only, and shall conform to ASTM A 74, ASME A112.3.1 or ASME A112.36.2M. Cleanouts with plate-style access covers shall be fitted with corrosion-resisting fasteners. Plastic cleanout plugs shall conform to the requirements of Section 4.2.4. Plugs shall have raised square or countersunk square heads. Countersunk heads shall be installed where raised heads are a trip hazard. Cleanout plugs with borosilicate glass systems shall be of borosilicate glass.

4.8.2.2 **Inspection chamber covers.** Inspection chambers shall conform to BS EN 124. All covers shall be secured and gas-tight with rubber gasket. Covers shall be installed on the ground and flushed with the finished floor. Covers placed in pedestrian access areas shall be capable to stand 1.5 ton load. Covers placed in car parks, domestic driveways areas with vehicle access shall be capable to stand 12.5 ton load.

4.8.3 **Where required.** Cleanouts or inspection chambers shall be located in accordance with Sections 4.8.3.1 through 4.8.3.5.

4.8.3.1 **Horizontal drains within buildings.** All horizontal drains shall be provided with cleanouts or inspection chambers located not more than 30 m apart.

4.8.3.2 **Building sewers.** Building sewers shall be provided with cleanouts or inspection chambers located not more than 30 m apart measured from the upstream entrance of the cleanout or inspection chambers. For building sewers 200 mm and larger, manholes shall be provided and located not more than 60 m from the junction of the building drain and building sewer, at each change in direction and at intervals of not more than 120 m apart. Manholes and manhole covers shall be of an approved type.

4.8.3.3 **Changes of direction.** Cleanouts or inspection chambers shall be installed at each change of direction of the building drain or horizontal waste or soil lines greater than 45 degrees. Where more than one change of direction occurs in a run of piping, only one cleanout or inspection chambers shall be required for each 12 m of developed length of the drainage piping.

4.8.3.4 **Base of stack.** A cleanout or inspection chambers shall be provided at the base of each waste or soil stack.

4.8.3.5 **Building drain and building sewer junction.** There shall be a cleanout or an inspection chamber near the junction of the building drain and the building sewer. The cleanout or inspection chamber shall be either inside or outside the building wall and shall be brought up to the finished ground level or to the basement floor level. An approved two-way cleanout is allowed to be used at this location to serve as a required cleanout for both the building drain and building sewer. The cleanout or inspection chamber at the junction of the building drain and building sewer shall not be required if the cleanout on a 75 mm or larger diameter soil stack is located within a developed length of 3 m of the building drain and building sewer connection. The minimum size of the cleanout or inspection chamber at the junction

of the building drain and building sewer shall comply with Section 4.8.7.

4.8.3.6 **Manholes.** Manholes serving a building drain shall have secured gas-tight covers and shall be located in accordance with Section 4.8.3.2.

4.8.4 **Concealed piping.** Cleanouts or inspection chambers on concealed piping or piping under a floor slab or in a crawl space of less than 0.60 m in height or a plenum shall be extended through and terminate flush with the finished wall, floor or ground surface or shall be extended to the outside of the building. Cleanout plugs and inspection chamber covers shall not be covered with cement, plaster or any other permanent finish material. Where it is necessary to conceal a cleanout or an inspection chamber, or to terminate it in an area subject to vehicular traffic, the covering plate, access door or cleanout or inspection chamber shall be of an approved type designed and installed for this purpose.

4.8.5 **Opening direction of cleanouts**. Every cleanout shall be installed to open to allow cleaning in the direction of the flow of the drainage pipe or at right angles thereto.

4.8.6 **Prohibited installation**. Cleanout openings shall not be utilized for the installation of new fixtures, except where approved and where another cleanout of equal access and capacity is provided.

4.8.7 **Minimum size.**

4.8.7.1 **Cleanouts**. Cleanouts shall be the same nominal size as the pipe they serve up to 100 mm. For pipes larger than 100 mm nominal size, the minimum size of the cleanout shall be 100 mm.

Exceptions:

1. "P" trap connections with slip joints or ground joint connections, or stack cleanouts that are not more than one pipe diameter smaller than the drain served, shall be permitted.
2. Cast-iron cleanout sizing shall be in accordance with referenced standards in Table 4.2.4, ASTM A 74 for hub and spigot fittings or ASTM A 888 or CISPI 301 for hubless fittings.

4.8.7.2 **Inspection chambers**. Inspection chamber dimensions depend on the size of the main drain and the number, size and position of branch drains entering. The size of inspection chambers should be such that the drain can be cleaned from surface. For inspection chamber has depth to invert of 0.5 m or less shall has a minimum internal dimension of 190 mm diameter for drains up to 150 mm diameter. Minimum nominal cover size 190 mm.

4.8.8 **Clearances.** Cleanouts and inspection chambers on 150 mm and smaller pipes shall be provided with a clearance of not less than 0.45 m for rodding. Cleanouts and inspection chambers on 200 mm and larger pipes shall be provided with a clearance of not less than 0.9 m for rodding.

4.8.9 **Access.** Access shall be provided to all cleanouts and inspection chambers.

4.8.10 **Preformed inspection chamber.** Preformed inspection chamber shall consist of Tough non-metallic plastic (polypropylene material) chamber base unit, raising pieces, and ductile or cast iron cover. The chamber base shall be installed on 100 mm thick concrete bed. The frame shall be bedded on mortar to a specific height set to suit the surrounding paving or ground level and the cover sits inside the frame. Performed inspection chambers shall be installed in accordance with

manufacturer's instructions.

4.8.11 **Field made inspection chamber.** Inspection chamber constructed on site shall be made in accordance with BS 8301.

4.8.12 **Testing inspection chamber.** All inspection chambers shall be tested for water-tightness prior to backfilling, as detailed in BS 8301 (Code of Practice for Building Drainage) and BS 8005 (Guide to new sewer construction).

SECTION 4.9
FIXTURE UNITS

4.9.1 **Values for fixtures.** Drainage fixture unit values as given in Table 4.9.1 designate the relative load weight of different kinds of fixtures that shall be employed in estimating the total load carried by a soil or waste pipe, and shall be used in connection with Tables 4.10.1(1) and 4.10.1(2) of sizes for soil, waste and vent pipes for which the permissible load is given in terms of fixture units.

4.9.2 **Fixtures not listed in Table 4.9.1.** Fixtures not listed in Table 4.9.1 shall have a drainage fixture unit load based on the outlet size of the fixture in accordance with Table 4.9.2. The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 32 mm.

4.9.3 **Values for continuous and semicontinuous flow.** Drainage fixture unit values for continuous and semicontinuous flow into a drainage system shall be computed on the basis that 3.5 ℓ/m of flow is equivalent to two fixture units.

4.9.4 **Values for indirect waste receptor.** The drainage fixture unit load of an indirect waste receptor receiving the discharge of indirectly connected fixtures shall be the sum of the drainage fixture unit values of the fixtures that discharge to the receptor, but not less than the drainage fixture unit value given for the indirect waste receptor in Table 4.9.1 or 4.9.2.

TABLE 4.9.1
DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (mm)
Automatic clothes washers, commercial [a,g]	3	50
Automatic clothes washers, residential [g]	2	50
Bathroom group. (6ℓ pf water closet)[f]	5	—
Bathroom group. (water closet flushing greater than 6ℓ pf) [f]	6	—
Bathtub [b] (with or without overhead shower or whirpool attachments)	2	40
Bidet	1	40
Combination sink and tray	2	40
Dental lavatory	1	40
Dental unit or cuspidor	1	40
Dishwashing machine,[c] domestic	2	40
Drinking fountain	½	40
Emergency floor drain	0	50
Floor drains	2	50
Kitchen sink, domestic	2	40
Kitchen sink, domestic with food waste grinder and/or dishwasher	2	40
Laundry tray (1 or 2 compartments)	2	40
Lavatory (Wash basin)	1	40
Shower	2	40
Sink	2	40
Urinal	4	Note d
Urinal, 3.5ℓ per flush or less	2[e]	Note d
Wash sink (circular or multiple) each set of faucets	2	40
Water closet, flushometer tank, public or private	4[e]	Note d
Water closet, private (6ℓ pf)	3[e]	Note d
Water closet, private (flushing greater than 6ℓ pf)	4[e]	Note d
Water closet, public (6ℓ pf)	4[e]	Note d
Water closet, public (flushing greater than 6ℓ pf)	6[e]	Note d

a. For traps larger than 75 mm use Table 4.9.2.
b. A showerhead over a bathtub or whirlpool bathtub attachment does not increase the drainage fixture unit value.
c. See Sections 4.9.2 through 4.9.4 for methods of computing unit value of fixtures not listed in this table or for rating of devices with intermittent flows.
d. Trap size shall be consistent with the fixture outlet size.
e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower drainage fixture unit unless the lower values are confirmed by testing.
f. For fixtures added to a dwelling unit bathroom group, add the dfu value of those additional fixtures to the bathroom group fixture count.
g. See Section 2.6.3 for sizing requirements for fixture drain, branch drain, and drainage stack for an automatic clothes washer standpipe.

TABLE 4.9.2
DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (mm)	DRAINAGE FIXTURE UNIT VALUE
40	2
50	3
65	4
75	5
100	6

SECTION 4.10
DRAINAGE SYSTEM SIZING

4.10.1 **Maximum fixture unit load.** The maximum number of drainage fixture units connected to a given size of building sewer, building drain or horizontal branch of the building drain shall be determined using Table 4.10.1(1). The maximum number of drainage fixture units connected to a given size of horizontal branch or vertical soil or waste stack shall be determined using Table 4.10.1(2).

4.10.1.1 **Horizontal stack offsets.** Horizontal stack offsets shall be sized as required for building drains in accordance with Table 4.10.1(1), except as required by Section 4.11.4.

TABLE 4.10.1 (1)
BUILDING DRAINS AND SEWERS

DIAMETER OF PIPE[b] (mm)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING DRAIN [a]			
	Slope Percent			
	½	1	2	4
40	—	—	3	3
50	—	—	21	26
65	—	—	24	31
75	—	36	42	50
100	—	180	216	250
125	—	390	480	575
150	—	700	840	1,000
200	1,400	1,600	1,920	2,300
250	2,500	2,900	3,500	4,200
300	3,900	4,600	5,600	6,700
350	5,750	7,000	8,375	10,000

a. The minimum size of any building drain serving a water closet shall be 100 mm.
b. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from SASO standards or pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

4.10.1.2 **Vertical stack offsets.** Vertical stack offsets shall be sized as required for straight stacks in accordance with Table 4.10.1(2), except where required to be sized as a building drain in accordance with Section 4.11.1.1.

4.10.2 **Future fixtures.** Where provision is made for the future installation of fixtures, those provided for shall be considered in determining the required sizes of drain pipes.

TABLE 4.10.1(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS [a]

DIAMETER OF PIPE [d] (mm)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
	Total for horizontal branch	Stacks [b]		
		Total discharge into one branch interval	Total for stack of three branch Intervals or less	Total for stack greater than three branch intervals
40	3	2	4	8
50	6	6	10	24
65	12	9	20	42
75	20	20	48	72
100	160	90	240	500
125	360	200	540	1,100
150	620	350	960	1,900
200	1,400	600	2,200	3,600
250	2,500	1,000	3,800	5,600
300	2,900	1,500	6,000	8,400
350	5,450	Note c	Note c	Note c

a. Does not include branches of the building drain. Refer to Table 4.10.1(1).
b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.
c. Sizing load based on design criteria.
d. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

SECTION 4.11
OFFSETS IN DRAINAGE PIPING IN BUILDINGS OF FIVE STORIES OR MORE

4.11.1 **Horizontal branch connections above or below vertical stack offsets.** If a horizontal branch connects to the stack within 0.6 m above or below a vertical stack offset, and the offset is located more than four branch intervals below the top of the stack, the offset shall be vented in accordance with Section 5.15.

4.11.1.1 **Omission of vents for vertical stack offsets.** Vents for vertical offsets required by Section 4.11.1 shall not be required where the stack and its offset are sized as a building drain [see Table 4.10.1(1), Column 5].

4.11.2 **Horizontal branch connections to horizontal stack offsets.** Where a horizontal stack offset is located more than four branch intervals below the top of the stack, a horizontal branch shall not connect within the horizontal stack offset or within 0.6 m above or below such offset.

4.11.3 **Horizontal stack offsets.** A stack with a horizontal offset located more than four branch intervals below the top of the stack shall be vented in accordance with Section 5.15 and sized as follows:

1. The portion of the stack above the offset shall be sized as for a vertical stack

based on the total number of drainage fixture units above the offset.

2. The offset shall be sized in accordance with Section 4.10.1.1.
3. The portion of the stack below the offset shall be sized as for the offset or based on the total number of drainage fixture units on the entire stack, whichever is larger [see Table 4.10.1(2), Column 4].

4.11.3.1 **Omission of vents for horizontal stack offsets.** Vents for horizontal stack offsets required by Section 4.11.3 shall not be required where the stack and its offset are one pipe size larger than required for a building drain [see Table 4.10.1(1), Column 5] and the entire stack and offset are not less in cross-sectional area than that required for a straight stack plus the area of an offset vent as provided for in Section 5.15. Omission of offset vents in accordance with this section shall not constitute approval of horizontal branch connections within the offset or within 0.6 m above or below the offset.

4.11.4 **Offsets below lowest branch.** Where a vertical offset occurs in a soil or waste stack below the lowest horizontal branch, change in diameter of the stack because of the offset shall not be required. If a horizontal offset occurs in a soil or waste stack below the lowest horizontal branch, the required diameter of the offset and the stack below it shall be determined as for a building drain in accordance with Table 4.10.1(1).

SECTION 4.12
SUMPS AND EJECTORS

4.12.1 **Building subdrains.** Building subdrains that cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump from which the liquid shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment or other approved method. In other than existing structures, the sump shall not receive drainage from any piping within the building capable of being discharged by gravity to the building sewer.

4.12.2 **Valves required.** A check valve and full open valve, located on the discharge side of the check valve, shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves will be located above the sump cover required by Section 4.12.1 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

Exception: In one- and two-family dwellings, only a check valve shall be required, located on the discharge piping from the sewage pump or ejector.

4.12.3 **Sump design.** The sump pump, pit and discharge piping shall conform to the requirements of Sections 4.12.3.1 through 4.12.3.5.

4.12.3.1 **Sump pump.** The sump pump capacity and head shall be appropriate to anticipated use requirements.

4.12.3.2 **Sump pit.** The sump pit shall be not less than 450 mm in diameter and 0.6 m deep, unless otherwise approved. The pit shall be accessible and located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, concrete, steel, plastic or other approved materials. The pit bottom shall be solid and provide permanent support for the pump. The sump pit shall be fitted with a gas-tight removable cover adequate to support anticipated loads in the area of use. The sump pit shall be vented in accordance with Chapter 5.

4.12.3.3 **Discharge piping.** Discharge piping shall meet the requirements of Section 4.12.2.

4.12.3.4 **Maximum effluent level.** The effluent level control shall be adjusted and maintained to at all times prevent the effluent in the sump from rising to within 50 mm of the invert of the gravity drain inlet into the sump.

4.12.3.5 **Ejector connection to the drainage system.** Pumps connected to the drainage system shall connect to the building sewer or shall connect to a wye fitting in the building drain a minimum of 3 m from the base of any soil stack, waste stack or fixture drain. Where the discharge line connects into horizontal drainage piping, the connector shall be made through a wye fitting into the top of the drainage piping.

4.12.4 **Sewage pumps and sewage ejectors.** A sewage pump or sewage ejector shall automatically discharge the contents of the sump to the building drainage system.

4.12.4.1 **Macerating toilet systems.** Macerating toilet systems shall comply with CSA B45.9 or ASME A9.2.3.4 and shall be installed in accordance with the manufacturer's installation instructions.

4.12.4.2 **Capacity.** A sewage pump or sewage ejector shall have the capacity and head for the application requirements. Pumps or ejectors that receive the discharge of water closets shall be capable of handling spherical solids with a diameter of up to and including 50 mm. Other pumps or ejectors shall be capable of handling spherical solids with a diameter of up to and including 25 mm. The minimum capacity of a pump or ejector based on the diameter of the discharge pipe shall be in accordance with Table 4.12.4.2.

Exceptions:

1. Grinder pumps or grinder ejectors that receive the discharge of water closets shall have a minimum discharge opening of 32 mm.
2. Macerating toilet assemblies that serve single water closets shall have a minimum discharge opening of 20 mm.

TABLE 4.12.4.2
MINIMUM CAPACITY OF SEWAGE PUMP OR SEWAGE EJECTOR

DIAMETER OF THE DISCHARGE PIPE (mm)	CAPACITY OF PUMP OR EJECTOR (ℓ/m)
50	80
65	115
75	175

SECTION 4.13
HEALTH CARE PLUMBING

4.13.1 **Scope.** This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to this section in addition to the other requirements of SBC 701. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes; homes for the aged; orphanages; infirmaries; first aid stations; psychiatric facilities; clinics; professional offices of dentists and doctors; mortuaries; educational facilities; surgery, dentistry, research and testing laboratories; establishments manufacturing pharmaceutical drugs and medicines; and other structures with similar apparatus and equipment classified as plumbing.

4.13.2 **Bedpan washers and clinical sinks.** Bedpan washers and clinical sinks shall connect to the drainage and vent system in accordance with the requirements for a water closet. Bedpan washers shall also connect to a local vent.

4.13.3 **Indirect waste.** All sterilizers, steamers and condensers shall discharge to the drainage through an indirect waste pipe by means of an air gap. Where a battery of not more than three sterilizers discharges to an individual receptor, the distance between the receptor and a sterilizer shall not exceed 2.5 m. The indirect waste pipe on a bedpan steamer shall be trapped.

4.13.4 **Vacuum system station.** Ready access shall be provided to vacuum system station receptacles. Such receptacles shall be built into cabinets or recesses and shall be visible.

4.13.5 **Bottle system.** Vacuum (fluid suction) systems intended for collecting, removing and disposing of blood, pus or other fluids by the bottle system shall be provided with receptacles equipped with an overflow prevention device at each vacuum outlet station.

4.13.6 **Central disposal system equipment.** All central vacuum (fluid suction) systems shall provide continuous service. Systems equipped with collecting or control tanks shall provide for draining and cleaning of the tanks while the system is in operation. In hospitals, the system shall be connected to the emergency power system. The exhausts from a vacuum pump serving a vacuum (fluid suction) system shall discharge separately to open air above the roof.

4.13.7 **Central vacuum or disposal systems.** Where the waste from a central vacuum (fluid suction) system of the barometric-lag, collection-tank or bottle-disposal type is connected to the drainage system, the waste shall be directly connected to the sanitary drainage system through a trapped waste.

4.13.7.1 **Piping.** The piping of a central vacuum (fluid suction) system shall be of corrosion-resistant material with a smooth interior surface. A branch shall not be less than 15 mm nominal pipe size for one outlet and shall be sized in accordance with the number of vacuum outlets. A main shall not be less than 25 mm nominal pipe size. The pipe sizing shall be increased in accordance with the manufacturer's instructions as stations are increased.

4.13.7.2 **Velocity.** The velocity of airflow in a central vacuum (fluid suction) system shall be less than 25 m/s.

4.13.8 **Vent connections prohibited.** Connections between local vents serving bedpan washers or sterilizer vents serving sterilizing apparatus and normal sanitary plumbing systems are prohibited. Only one type of apparatus shall be served by a local vent.

4.13.9 **Local vents and stacks for bedpan washers.** Bedpan washers shall be vented to open air above the roof by means of one or more local vents. The local vent for a bedpan washer shall not be less than a 50 mm pipe. A local vent serving a single bedpan washer is permitted to drain to the fixture served.

4.13.9.1 **Multiple installations.** Where bedpan washers are located above each other on more than one floor, a local vent stack is permitted to be installed to receive the local vent on the various floors. Not more than three bedpan washers shall be connected to a 50 mm local vent stack, not more than six to a 75 mm local vent stack and not more than 12 to a 100 mm local vent stack. In multiple installations, the connections between a

bedpan washer local vent and a local vent stack shall be made with tee or tee-wye sanitary pattern drainage fittings installed in an upright position.

4.13.9.2 **Trap required.** The bottom of the local vent stack, except where serving only one bedpan washer, shall be drained by means of a trapped and vented waste connection to the sanitary drainage system. The trap and waste shall be the same size as the local vent stack.

4.13.9.3 **Trap seal maintenance.** A water supply pipe not less than 6 mm in diameter shall be taken from the flush supply of each bedpan washer on the discharge or fixture side of the vacuum breaker, shall be trapped to form not less than a 75 mm water seal, and shall be connected to the local vent stack on each floor. The water supply shall be installed so as to provide a supply of water to the local vent stack for cleansing and drain trap seal maintenance each time a bedpan washer is flushed.

4.13.10 **Sterilizer vents and stacks.** Multiple installations of pressure and nonpressure sterilizers shall have the vent connections to the sterilizer vent stack made by means of inverted wye fittings. Access shall be provided to vent connections for the purpose of inspection and maintenance.

4.13.10.1 **Drainage.** The connection between sterilizer vent or exhaust openings and the sterilizer vent stack shall be designed and installed to drain to the funnel or basket-type waste fitting. In multiple installations, the sterilizer vent stack shall be drained separately to the lowest sterilizer funnel or basket-type waste fitting or receptor.

4.13.11 **Sterilizer vent stack sizes.** Sterilizer vent stack sizes shall comply with Sections 4.13.11.1 through 4.13.11.4.

4.13.11.1 **Bedpan steamers.** The minimum size of a sterilizer vent serving a bedpan steamer shall be 40 mm in diameter. Multiple installations shall be sized in accordance with Table 4.13.11.1.

4.13.11.2 **Boiling-type sterilizers.** The minimum size of a sterilizer vent stack shall be 50 mm in diameter where serving a utensil sterilizer and 40 mm in diameter where serving an instrument sterilizer. Combinations of boiling-type sterilizer vent connections shall be sized in accordance with Table 4.13.11.1.

4.13.11.3 **Pressure sterilizers.** Pressure sterilizer vent stacks shall be 65 mm minimum. Those serving combinations of pressure sterilizer exhaust connections shall be sized in accordance with Table 4.13.11.3.

TABLE 4.13.11.1
STACK SIZES FOR BEDPAN STEAMERS AND BOILING-TYPE STERILIZERS
(Number of Connections of Various Sizes Permitted to Various-sized Sterilizer Vent Stacks)

STACK SIZE[c] (mm)	CONNECTION SIZE (mm)		
	40		50
40 [a]	1	or	0
50 [a]	2	or	1
50 [b]	1	and	1
75 [a]	4	or	2
75 [b]	2	and	2
100 [a]	8	or	4
100 [b]	4	and	4

a. Total of each size.
b. Combination of sizes.
c. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

4.13.11.4 **Pressure instrument washer sterilizer sizes.** The minimum diameter of a sterilizer vent stack serving an instrument washer sterilizer shall be 50 mm. Not more than two sterilizers shall be installed on a 50 mm stack, and not more than four sterilizers shall be installed on a 75 mm stack.

TABLE 4.13.11.3
STACK SIZES FOR PRESSURE STERILIZERS
(Number of Connections of Various Sizes Permitted To Various-sized Vent Stacks)

STACK SIZE (mm)	**CONNECTION SIZE (mm)**			
	20	25	32	40
40 [a]	3 or	2 or	1	—
40 [b]	2 and	1	—	—
50 [a]	6 or	3 or	2 or	1
50 [b]	3 and	2	—	—
50 [b]	2 and	1 and	1	—
50 [b]	1 and	1 and	—	1
75 [a]	15 or	7 or	5 or	3
75 [b]	1 and	1 and 5 and	2 and —	2 1

a. Total of each size.
b. Combination of sizes.
c. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

SECTION 4.14
COMPUTERIZED DRAINAGE DESIGN

4.14.1 **Design of drainage system.** The sizing, design and layout of the drainage system shall be permitted to be designed by approved computer design methods.

4.14.2 **Load on drainage system.** The load shall be computed from the simultaneous or sequential discharge conditions from fixtures, appurtenances and appliances or the peak usage design condition.

4.14.2.1 **Fixture discharge profiles.** The discharge profiles for flow rates versus time from fixtures and appliances shall be in accordance with the manufacturer's specifications.

4.14.3 **Selections of drainage pipe sizes.** Pipe shall be sized to prevent full-bore flow.

4.14.3.1 **Selecting pipe wall roughness**. Pipe size calculations shall be conducted with the pipe wall roughness factor (k_S), in accordance with the manufacturer's specifications and as modified for aging roughness factors with deposits and corrosion.

4.14.3.2 **Slope of horizontal drainage piping.** Horizontal drainage piping shall be designed and installed at slopes in accordance with Table 4.4.1.

SECTION 4.15
BACKWATER VALVES

4.15.1 **Sewage backflow.** Where the flood level rims of plumbing fixtures are below the elevation of the manhole cover of the next upstream manhole in the public sewer, such fixtures shall be protected by a backwater valve installed in the building drain, branch of the building drain or horizontal branch serving such fixtures. Plumbing fixtures having flood level rims above the elevation of the manhole cover of the next upstream manhole in the public sewer shall not discharge through a backwater valve.

4.15.2 **Material.** All bearing parts of backwater valves shall be of corrosion-resistant material. Backwater valves shall comply with ASME A112.14.1, CSA B181.1 or CSA B181.2.

4.15.3 **Seal.** Backwater valves shall be so constructed as to provide a mechanical seal against backflow.

4.15.4 **Diameter.** Backwater valves, when fully opened, shall have a capacity not less than that of the pipes in which they are installed.

4.15.5 **Location.** Backwater valves shall be installed so that access is provided to the working parts for service and repair.

SECTION 4.16
INDIRECT WASTE PIPING

4.16.1 **Where required.** Food-handling equipment and clear-water waste shall discharge through an indirect waste pipe as specified in Sections 4.16.1.1 through 4.16.1.9. All health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with Section 4.16 and Section 4.13.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with this Chapter.

4.16.1.1 **Food handling equipment and fixtures.** Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap.

4.16.1.2 **Floor drains in food storage areas.** Floor drains located within walk-in refrigerators or freezers in food service and food establishments shall be indirectly connected to the sanitary drainage system by means of an air gap. Where a floor drain is located within an area subject to freezing, the waste line serving the floor drain shall not be trapped and shall indirectly discharge into a waste receptor located outside of the area subject to freezing.

Exception: Where protected against backflow by a backwater valve, such floor drains shall be indirectly connected to the sanitary drainage system by means of an air break or an air gap.

4.16.1.3 **Potable clear-water waste.** Where devices and equipment, such as sterilizers and relief valves, discharge potable water to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air gap.

4.16.1.4 **Swimming pools.** Where wastewater from swimming pools, backwash from filters and water from pool deck drains discharge to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air gap.

4.16.1.5 **Nonpotable clear-water waste.** Where devices and equipment such as process tanks, filters, drips and boilers discharge nonpotable water to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air break or an air gap.

4.16.1.6 **Domestic dishwashing machines.** Domestic dishwashing machines shall discharge indirectly through an air gap or air break into a standpipe or waste receptor in accordance with Section 4.16.2, or discharge into a wye-branch fitting on the tailpiece of the kitchen sink or the dishwasher connection of a food waste grinder. The waste line of a domestic dishwashing machine discharging into a kitchen sink tailpiece or food waste grinder shall connect to a deck-mounted air gap or the waste line shall rise and be securely fastenend to the underside of the sink rim or counter.

4.16.1.7 **Commercial dishwashing machines.** The discharge from a commercial dishwashing machine shall be through an air gap or air break into a standpipe or waste receptor in accordance with Section 4.16.2.

4.16.1.8 **Condensate waste.** Drain piping for condensate waste from air conditioning cooling coils and drinking fountain shall be indirectly connected to a floor drain, or shall be indirectly connected into the inlet side of P-trap.

4.16.2 **Installation**. All indirect waste piping shall discharge through an air gap or air break into a waste receptor or standpipe. Waste receptors and standpipes shall be trapped and vented and shall connect to the building drainage system. All indirect waste piping that exceeds 0.6 m in developed length measured horizontally, or 1.2 m in total developed length, shall be trapped.

4.16.2.1 **Air gap.** The air gap between the indirect waste pipe and the flood level rim of the waste receptor shall be a minimum of twice the effective opening of the indirect waste pipe.

4.16.2.2 **Air break.** An air break shall be provided between the indirect waste pipe and the trap seal of the waste receptor or standpipe.

4.16.3 **Waste receptors.** Every waste receptor shall be of an approved type. A removable strainer or basket shall cover the waste outlet of waste receptors. Waste receptors shall be installed in ventilated spaces. Waste receptors shall not be installed in bathrooms or toilet rooms or in any inaccessible or unventilated space such as a closet or storeroom. Ready access shall be provided to waste receptors.

4.16.3.1 **Size of receptors.** A waste receptor shall be sized for the maximum discharge of all indirect waste pipes served by the receptor. Receptors shall be installed to prevent splashing or flooding.

4.16.3.2 **Open hub waste receptors.** Waste receptors shall be permitted in the form of a hub or pipe extending not less than 25 mm above a water-impervious floor and are not required to have a strainer.

4.16.4 **Standpipes.** Standpipes shall be individually trapped. Standpipes shall extend a minimum of 0.5 m and a maximum of 1 m above the trap weir. Access shall be provided to all standpipes and drains for rodding.

SECTION 4.17
SPECIAL WASTES

4.17.1 **Wastewater temperature.** Steam pipes shall not connect to any part of a drainage or plumbing system and water above 60^{o}C shall not be discharged into any part of a drainage system. Such pipes shall discharge into an indirect waste receptor connected to the drainage system.

4.17.2 **Neutralizing device required for corrosive wastes.** Corrosive liquids, spent acids or other harmful chemicals that destroy or injure a drain, sewer, soil or waste pipe, or create noxious or toxic fumes or interfere with sewage treatment processes shall not be discharged into the plumbing system without being thoroughly diluted, neutralized or treated by passing through an approved dilution or neutralizing device. Such devices shall be automatically provided with a sufficient supply of diluting water or neutralizing medium so as to make the contents noninjurious before discharge into the drainage system. The nature of the corrosive or harmful waste and the method of its treatment or dilution shall be approved prior to installation.

4.17.3 **System design.** A chemical drainage and vent system shall be designed and installed in accordance with these requirements SBC 701. Chemical drainage and vent systems shall be completely separated from the sanitary systems. Chemical waste shall not discharge to a sanitary drainage system until such waste has been treated in accordance with Section 4.17.2.

SECTION 4.18
TRAP REQUIREMENTS

4.18.1 **Fixture traps.** Each plumbing fixture shall be separately trapped by a water-seal trap, except as otherwise permitted by these requirements SBC 701. The trap shall be placed as close as possible to the fixture outlet. The vertical distance from the fixture outlet to the trap weir shall not exceed 0.6 m. The distance of a clothes washer standpipe above a trap shall conform to Section 4.16.4. A fixture shall not be double trapped.

Exceptions:

1. This section shall not apply to fixtures with integral traps.
2. A combination plumbing fixture is permitted to be installed on one trap provided that one compartment is not more than 0.15 m deeper than the other compartment and the waste outlets are not more than 0.75 m apart.
3. A grease trap intended to serve as a fixture trap in accordance with the manufacturer's installation instructions shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 0.75 m, and the developed length of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 1.5 m.

4.18.2 **Design of traps.** Fixture traps shall be self-scouring. Fixture traps shall not have interior partitions, except where such traps are integral with the fixture or where such traps are constructed of an approved material that is resistant to corrosion and degradation. Slip joints shall be made with an approved elastomeric gasket and shall be installed only on the trap inlet, trap outlet and within the trap seal.

4.18.3 **Prohibited traps.** The following types of traps are prohibited:

1. Traps that depend on moving parts to maintain the seal.
2. Bell traps.
3. Crown-vented traps.
4. Traps not integral with a fixture and that depend on interior partitions for the seal, except those traps constructed of an approved material that is resistant to corrosion and degradation.

5. "S" traps.
6. Drum traps.
Exception: Drum traps used as solids interceptors and drum traps serving chemical waste systems shall not be prohibited.

4.18.4 **Trap seals.** Each fixture trap shall have a liquid seal of not less than 50 mm and not more than 100 mm, deeper for special designs relating to accessible fixtures. Where a trap seal is subject to loss by evaporation, a trap seal primer valve shall be installed. A trap seal primer valve shall conform to ASSE 1018 or ASSE 1044.

4.18.5 **Size of fixture traps.** Fixture trap size shall be sufficient to drain the fixture rapidly and not less than the size indicated in Table 4.9.1. A trap shall not be larger than the drainage pipe into which the trap discharges.

4.18.6 **Building traps.** Building (house) traps shall be prohibited, except where local conditions necessitate such traps. Building traps shall be provided with a cleanout and a relief vent or fresh air intake on the inlet side of the trap. The size of the relief vent or fresh air intake shall not be less than one-half the diameter of the drain to which the relief vent or air intake connects. Such relief vent or fresh air intake shall be carried above grade and shall be terminated in a screened outlet located outside the building.

4.18.7 **Trap setting and protection.** Traps shall be set level with respect to the trap seal and, where necessary, shall be protected from freezing.

4.18.8 **Recess for trap connection.** A recess provided for connection of the underground trap, such as one serving a bathtub in slab-type construction, shall have sides and a bottom of corrosion-resistant, insect and verminproof construction.

4.18.9 **Acid-resisting traps.** Where a vitrified clay or other brittleware, acid-resisting trap is installed underground, such trap shall be embedded in concrete extending 0.15 m beyond the bottom and sides of the trap.

4.18.10 **Plumbing in mental health centers.** In mental health centers, pipes and traps shall not be exposed.

SECTION 4.19
INTERCEPTORS AND SEPARATORS

4.19.1 **Where required.** Interceptors and separators shall be provided to prevent the discharge of oil, grease, sand and other substances harmful or hazardous to the building drainage system, the public sewer, or sewage treatment plant or processes.

4.19.2 **Approval.** The size, type and location of each interceptor and of each separator shall be designed and installed in accordance with the manufacturer's instructions and the requirements of this section based on the anticipated conditions of use. Wastes that do not require treatment or separation shall not be discharged into any interceptor or separator.

4.19.3 **Grease traps and grease interceptors.** Grease traps and grease interceptors shall comply with the requirements of Sections 4.19.3.1 through 4.19.3.4.2.

4.19.3.1 Grease traps and grease interceptors required. A grease trap or grease interceptor shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, café's, factory cafeterias, or restaurants and clubs.

4.19.3.2 Food waste grinders. Where food waste grinders connect to grease traps, a solids interceptor shall separate the discharge before connecting to the grease trap. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste grinder.

4.19.3.3 Grease trap and grease interceptor not required. A grease trap or a grease interceptor shall not be required for individual dwelling units or any private living quarters.

4.19.3.4 Grease traps and grease interceptors. Grease traps and grease interceptors shall conform to PDI G101, ASME A 112.14.3 or ASME A112.14.4 and shall be installed in accordance with the manufacturer's instructions.

4.19.3.4.1 Grease trap capacity. Grease traps shall have the grease retention capacity indicated in Table 4.19.3.4.1 for the flow-through rates indicated.

4.19.3.4.2 Rate of flow controls. Grease traps shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 0.15 m above the flood rim level or be installed in accordance with the manufacturer's instructions.

TABLE 4.19.3.4.1
CAPACITY OF GREASE TRAPS

TOTAL FLOW-THROUGH RATING (L/m)	GREASE RETENTION CAPACITY (kg)
15	3.5
23	5.5
27	6.5
34	8
38	9
45	11
53	13
57	14
68	16
76	18
95	23
133	32
189	45

4.19.4 Oil separators required. At repair garages, car washing facilities with engine or undercarriage cleaning capability and at factories where oily and flammable liquid wastes are produced, separators shall be installed into which all oil-bearing, grease-bearing or flammable wastes shall be discharged before emptying in the building drainage system or other point of disposal.

4.19.4.1 **Separation of liquids.** A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an approved receptacle.

4.19.4.2 **Oil separator design.** Oil separators shall be designed in accordance with Sections 4.19.4.2.1 and 4.19.4.2.2.

4.19.4.2.1 **General design requirements.** Oil separators shall have a depth of not less than 0.6 m below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 0.45 m water seal.

4.19.4.2.2 **Garages and service stations.** Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a minimum capacity of 0.17 m^3 for the first 9.3 m^2 of area to be drained, plus 0.03 m^3 for each additional 9 m^2 of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator.

4.19.5 **Sand interceptors in commercial establishments.** Sand and similar interceptors for heavy solids shall be designed and located so as to be provided with ready access for cleaning, and shall have a water seal of not less than 0.15 m.

4.19.6 **Laundries.** Commercial laundries shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, that prevents passage into the drainage system of solids 15 mm or larger in size, string, rags, buttons or other materials detrimental to the public sewage system.

4.19.7 **Bottling establishments.** Bottling plants shall discharge process wastes into an interceptor that will provide for the separation of broken glass or other solids before discharging waste into the drainage system.

4.19.8 **Slaughterhouses.** Slaughtering room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the drainage system of feathers, entrails and other materials that cause clogging.

4.19.9 **Venting of interceptors and separators.** Interceptors and separators shall be designed so as not to become air bound where tight covers are utilized. Each interceptor or separator shall be vented where subject to a loss of trap seal.

4.19.10 **Access and maintenance of interceptors and separators.** Access shall be provided to each interceptor and separator for service and maintenance. Interceptors and separators shall be maintained by periodic removal of accumulated grease, scum, oil, or other floating substances and solids deposited in the interceptor or separator.

CHAPTER 5
SANITARY DRAINAGE VENTING SYSTEMS

SECTION 5.1
GENERAL

5.1.1 **Scope.** The provisions of this chapter shall govern the materials, design, construction and installation of vent systems.

5.1.2 **Trap seal protection.** The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air so that the seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 250 Pa.

5.1.2.1 **Venting required.** Every trap and trapped fixture shall be vented in accordance with one of the venting methods specified in this chapter.

5.1.3 **Chemical waste vent system.** The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the open air.

5.1.4 **Use limitations.** The plumbing vent system shall not be utilized for purposes other than the venting of the plumbing system.

5.1.5 **Tests.** The vent system shall be tested in accordance with Section 1.12.

5.1.6 **Engineered systems.** Engineered venting systems shall conform to the provisions of Section 5.18.

SECTION 5.2
MATERIALS

5.2.1 **Vents.** The materials and methods utilized for the construction and installation of venting systems shall comply with the applicable provisions of Section 4.2.

5.2.2 **Sheet copper.** Sheet copper for vent pipe flashings shall conform to ASTM B 152 and shall weigh not less than 2.5 kg/m^2.

5.2.3 **Sheet lead**. Sheet lead for vent pipe flashings shall weigh not less than 15 kg/m^2 for field-constructed flashings and not less than 12 kg/m^2 for prefabricated flashings.

SECTION 5.3
VENT STACKS AND STACK VENTS

5.3.1 **Stack required.** Every building in which plumbing is installed shall have at least one stack the size of which is not less than one-half of the required size of the building drain. Such stack shall run undiminished in size and as directly as possible from the building drain through to the open air or to a vent header that extends to the open air.

5.3.1.1 **Connection to drainage system.** A vent stack shall connect to the building drain or to the base of a drainage stack in accordance with Section 5.3.4. A stack vent shall be an extension of the drainage stack.

5.3.2 **Vent stack required.** A vent stack shall be required for every drainage stack that is five branch intervals or more.

5.3.3 **Vent termination.** Every vent stack or stack vent shall extend outdoors and terminate to the open air.

5.3.4 **Vent connection at base.** Every vent stack shall connect to the base of the drainage stack. The vent stack shall connect at or below the lowest horizontal branch. Where the vent stack connects to the building drain, the connection shall be located downstream of the drainage stack and within a distance of 10 times the diameter of the drainage stack.

5.3.5 **Vent headers.** Stack vents and vent stacks connected into a common vent header at the top of the stacks and extending to the open air at one point shall be sized in accordance with the requirements of Section 5.16.1. The number of fixture units shall be the sum of all fixture units on all stacks connected thereto, and the developed length shall be the longest vent length from the intersection at the base of the most distant stack to the vent terminal in the open air, as a direct extension of one stack.

SECTION 5.4
VENT TERMINALS

5.4.1 **Roof extension.** All open vent pipes that extend through a roof shall be terminated at least 0.3 m above the roof, except that where a roof is to be used for any purpose other than weather protection, the vent extensions shall be run at least 2 m above the roof.

5.4.2 **Flashings.** The juncture of each vent pipe with the roof line shall be made water tight by an approved flashing.

5.4.3 **Prohibited use.** Vent terminals shall not be used as a flag pole or to support flag poles, television aerials or similar items, except when the piping has been anchored in an approved manner.

5.4.4 **Location of vent terminal.** An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building and any such vent terminal shall not be within 3 m horizontally of such an opening unless it is at least 0.6 m above the top of such opening.

5.4.5 **Extension through the wall.** Vent terminals extending through the wall shall terminate a minimum of 3 m from the lot line and 3 m above average ground level. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

SECTION 5.5
VENT CONNECTIONS AND GRADES

5.5.1 **Connection.** All individual, branch and circuit vents shall connect to a vent stack, stack vent, air admittance valve or extend to the open air.

5.5.2 **Grade.** All vent and branch vent pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.

5.5.3 **Vent connection to drainage system.** Every dry vent connecting to a horizontal drain shall connect above the centerline of the horizontal drain pipe.

5.5.4 **Vertical rise of vent.** Every dry vent shall rise vertically to a minimum of 0.15 m above the flood level rim of the highest trap or trapped fixture being vented.
Exception: Vents for interceptors located outdoors.

5.5.5 **Height above fixtures.** A connection between a vent pipe and a vent stack or stack vent shall be made at least 0.15 m above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents or loop vents shall be at least 0.15 m above the flood level rim of the highest fixture served.

5.5.6 **Vent for future fixtures.** Where the drainage piping has been roughed-in for future fixtures, a rough-in connection for a vent shall be installed. The vent size shall be not less than one half the diameter of the rough-in drain to be served. The vent rough-in shall connect to the vent system, or shall be vented by other means as provided for in this chapter. The connection shall be identified to indicate that it is a vent.

SECTION 5.6
FIXTURE VENTS

5.6.1 **Distance of trap from vent.** Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 5.6.1.

5.6.2 **Venting of fixture drains**. The vent for a fixture drain, except where serving a fixture with integral traps, such as water closets, shall connect above the weir of the fixture trap being vented.

5.6.3 **Crown vent.** A vent shall not be installed within two pipe diameters of the trap weir.

TABLE 5.6.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (mm)	SIZE OF FIXTURE DRAIN (mm)	SLOPE (%)	DISTANCE FROM TRAP (m)
32	40	2	1.5
40	40	2	1.5
40	50	2	1.8
50	50	2	1.8
75	75	1	3
100	100	1	3.7

SECTION 5.7
INDIVIDUAL VENT

5.7.1 **Individual vent permitted.** Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the fixture drain of the trap or trapped fixture being vented.

SECTION 5.8
COMMON VENT

5.8.1 **Individual vent as common vent.** An individual vent is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.

5.8.2 **Connection at the same level.** Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection.

5.8.3 **Connection at different levels.** Where the fixture drains connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two fixture drains shall be considered the vent for the lower fixture drain, and shall be sized in accordance with Table 5.8.3. The upper fixture shall not be a water closet.

TABLE 5.8.3
COMMON VENT SIZES

PIPE SIZE (mm)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
40	1
50	4
65 to 75	6

SECTION 5.9
WET VENTING

5.9.1 **Wet vent permitted.** Any combination of fixtures within two bathroom groups located on the same floor level are permitted to be vented by a wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe to the most downstream fixture drain connection to the horizontal branch drain. Only the fixtures within the bathroom groups shall connect to the wet-vented horizontal branch drain. Any additional fixtures shall discharge downstream of the wet vent.

5.9.1.1 **Vertical wet vent.** Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a vertical wet vent. The vertical wet vent shall extend from the connection to the dry vent down to the lowest fixture drain connection. Each fixture shall connect independently to the vertical wet vent. Water closet drains shall connect at the same elevation. Other fixture drains shall connect above or at the same elevation as the water closet fixture drains. The dry vent connection to the vertical wet vent shall be an individual or common vent serving one or two fixtures.

5.9.2 **Vent connection.** The dry vent connection to the wet vent shall be an individual vent or common vent to the lavatory, bidet, shower or bathtub. The dry vent shall be sized based on the largest required diameter of pipe within the wet vent system served by the dry vent.

5.9.3 **Size.** The wet vent shall be of a minimum size as specified in Table 5.9.3, based on the fixture unit discharge to the wet vent.

TABLE 5.9.3
WET VENT SIZE

WET VENT PIPE SIZE (mm)	DRAINAGE FIXTURE UNIT LOAD (dfu)
40	1
50	4
65	6
75	12

SECTION 5.10
WASTE STACK VENT

5.10.1 **Waste stack vent permitted.** A waste stack shall be considered a vent for all of the fixtures discharging to the stack where installed in accordance with the requirements of this section.

5.10.2 **Stack installation.** The waste stack shall be vertical, and both horizontal and vertical offsets shall be prohibited. Every fixture drain shall connect separately to the waste stack. The stack shall not receive the discharge of water closets or urinals.

5.10.3 **Stack vent.** A stack vent shall be provided for the waste stack. The size of the stack vent shall be equal to the size of the waste stack. Offsets shall be permitted in the stack vent and shall be located at least 0.15 m above the flood level of the highest fixture, and shall be in accordance with Section 5.5.2.

5.10.4 **Waste stack size.** The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 5.10.4. The waste stack shall be the same size throughout its length.

TABLE 5.10.4
WASTE STACK VENT SIZE

STACK SIZE[a] (mm)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	**Total discharge for stack**
40	1	2
50	2	4
65	No limit	8
75	No limit	24
100	No limit	50
125	No limit	75
150	No limit	100

a. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from SASO standards or pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

SECTION 5.11
CIRCUIT VENTING

5.11.1 **Circuit vent permitted.** A maximum of eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each fixture drain shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream fixture drain connection to the most upstream fixture drain connection to the horizontal branch.

5.11.1.1 **Multiple circuit-vented branches.** Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.

5.11.2 **Vent connection.** The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 5.5. The circuit vent pipe shall not receive the discharge of any soil or waste.

5.11.3 **Slope and size of horizontal branch.** The maximum slope of the vent section of the horizontal branch drain shall be 8-percent slope. The entire length of the vent section of the horizontal branch drain shall be sized for the total drainage discharge to the branch.

5.11.3.1 **Size of multiple circuit vent.** Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section 5.11.3. The downstream circuit-vented horizontal branch shall be sized for the total discharge into the branch, including the upstream branches and the fixtures within the branch.

5.11.4 **Relief vent.** A relief vent shall be provided for circuit vented horizontal branches receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches.

5.11.4.1 **Connection and installation.** The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain of the

circuit vent. The relief vent shall be installed in accordance with Section 5.5.

5.11.4.2 **Fixture drain or branch.** The relief vent is permitted to be a fixture drain or fixture branch for fixtures located within the same branch interval as the circuit-vented horizontal branch. The maximum discharge to a relief vent shall be four fixture units.

5.11.5 **Additional fixtures.** Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.

SECTION 5.12
COMBINATION DRAIN AND VENT SYSTEM

5.12.1 **Type of fixtures.** A combination drain and vent system shall not serve fixtures other than floor drains, sinks, lavatories and drinking fountains. Combination drain and vent systems shall not receive the discharge from a food waste grinder or clinical sink.

5.12.2 **Installation.** The only vertical pipe of a combination drain and vent system shall be the connection between the fixture drain of a sink, lavatory or drinking fountain, and the horizontal combination drain and vent pipe. The maximum vertical distance shall be 2.5 m.

5.12.2.1 **Slope.** The horizontal combination drain and vent pipe shall have a maximum slope of 4 percent slope. The minimum slope shall be in accordance with Table 4.4.1.

5.12.2.2 **Connection.** The combination drain and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that is vented in accordance with one of the venting methods specified in this chapter. Combination drain and vent systems connecting to building drains receiving only the discharge from a stack or stacks shall be provided with a dry vent. The vent connection to the combination drain and vent pipe shall extend vertically a minimum of 0.15 m above the flood level rim of the highest fixture being vented before offsetting horizontally.

5.12.2.3 **Vent size.** The vent shall be sized for the total drainage fixture unit load in accordance with Section 5.16.2.

5.12.2.4 **Fixture branch or drain.** The fixture branch or fixture drain shall connect to the combination drain and vent within a distance specified in Table 5.6.1. The combination drain and vent pipe shall be considered the vent for the fixture.

5.12.3 **Size.** The minimum size of a combination drain and vent pipe shall be in accordance with Table 5.12.3.

TABLE 5.12.3
SIZE OF COMBINATION DRAIN AND VENT PIPE

DIAMETER OF PIPE[a] (mm)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
50	3	4
65	6	26
75	12	31
100	20	50
125	160	250
150	360	575

a. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

SECTION 5.13
ISLAND FIXTURE VENTING

5.13.1 **Limitation.** Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

5.13.2 **Vent connection.** The island fixture vent shall connect to the fixture drain as required for an individual or common vent. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 0.15 m above the highest island fixture being vented before connecting to the outside vent terminal.

5.13.3 **Vent installation below the fixture flood level rim.** The vent located below the flood level rim of the fixture being vented shall be installed as required for drainage piping in accordance with Chapter 4, except for sizing. The vent shall be sized in accordance with Section 5.16.2. The lowest point of the island fixture vent shall connect full size to the drainage system. The connection shall be to a vertical drain pipe or to the top half of a horizontal drain pipe. Cleanouts shall be provided in the island fixture vent to permit rodding of all vent piping located below the flood level rim of the fixtures. Rodding in both directions shall be permitted through a cleanout.

SECTION 5.14
RELIEF VENTS—STACKS OF MORE THAN 10 BRANCH INTERVALS

5.14.1 **Where required.** Soil and waste stacks in buildings having more than 10 branch intervals shall be provided with a relief vent at each tenth interval installed, beginning with the top floor.

5.14.2 **Size and connection.** The size of the relief vent shall be equal to the size of the vent stack to which it connects. The lower end of each relief vent shall connect to the soil or waste stack through a wye below the horizontal branch serving the floor, and the upper end shall connect to the vent stack through a wye not less than 1 m above the floor.

SECTION 5.15
VENTS FOR STACK OFFSETS

5.15.1 **Vent for horizontal offset of drainage stack.** Horizontal offsets of drainage stacks shall be vented where five or more branch intervals are located above the offset. The offset shall be vented by venting the upper section of the drainage stack and the lower section of the drainage stack.

5.15.2 **Upper section.** The upper section of the drainage stack shall be vented as a separate stack with a vent stack connection installed in accordance with Section 5.3.4. The offset shall be considered the base of the stack.

5.15.3 **Lower section.** The lower section of the drainage stack shall be vented by a yoke vent connecting between the offset and the next lower horizontal branch. The yoke vent connection shall be permitted to be a vertical extension of the drainage stack. The size of the yoke vent and connection shall be a minimum of the size required for the vent stack of the drainage stack.

SECTION 5.16
VENT PIPE SIZING

5.16.1 **Size of stack vents and vent stacks.** The minimum required diameter of stack vents and vent stacks shall be determined from the developed length and the total of drainage fixture units connected thereto in accordance with Table 5.16.1, but in no case shall the diameter be less than one-half the diameter of the drain served or less than 32 mm.

5.16.2 **Vents other than stack vents or vent stacks.** The diameter of individual vents, branch vents, circuit vents and relief vents shall be at least one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Table 4.10.1(2). Vent pipes shall not be less than 32 mm in diameter. Vents exceeding 12 m in developed length shall be increased by one nominal pipe size for the entire developed length of the vent pipe. Relief vents for soil and waste stacks in buildings having more than 10 branch intervals shall be sized in accordance with Section 5.14.2.

5.16.3 **Developed length.** The developed length of individual, branch, circuit and relief vents shall be measured from the farthest point of vent connection to the drainage system to the point of connection to the vent stack, stack vent or termination outside of the building.

TABLE 5.16.1
SIZE AND DEVELOPED LENGTH OF STACK VENTS AND VENT STACKS

DIAMETER OF SOIL OR WASTE STACK[b] (mm)	TOTAL FIXTURE UNITS BEING VENTED (dfu)	MAXIMUM DEVELOPED LENGTH OF VENT (m)[a] DIAMETER OF VENT (mm)										
		32	40	50	65	75	100	125	150	200	250	300
40	8	15	45	—	—	—	—	—	—	—	—	—
40	10	9	30									
50	12	9	9	23	60							
50	20	8	8	15	45		—	—	—	—	—	—
65	42			9	30	90						
75	10		13	45	110	317						
75	21	—	10	36	82	247	—	—	—	—	—	—
75	53		8	29	70	207						
75	102		8	26	64	189						
100	43	—		11 8	26	76	299	—	—	—	—	—
100	140				110	60	229					
100	320			7	17	52	195					
100	540	—	—	7	15	45	177		—	—	—	—
125	190				9	25	98	302				
125	490				7	19	76	232				
125	940	—	—	—	5	16.2	64	204	—	—	—	—
125	1,400				5	14.9	58	180				
150	500					10.1	40	122	305			
150	1,100	—	—	—	—	8	30	94	238	—	—	—
150	2,000					7	26	79	201			
150	2,900					6	24	73	183			
200	1,800	—	—	—	—		10	29	73	287	—	—
200	3,400						7	22	58	219		
200	5,600						6	19	49	186		
200	7,600	—	—	—	—	—	5	17.1	171	171		—
250	4000							10	94	94	293	
250	7,200							7.3	18.3	73	226	
250	11,000	—	—	—	—	—		6	15	60	192	—
250	15,000							5	14	55	174	
300	7,300								10	37	116	287
300	13,000	—	—	—	—	—	—	—	7	29	90	219
300	20,000								6	24	76	186
300	26,000								5	22	70	152
350	11300	—	—	—	—	—	—	—	4	20	62	141
350	19500									18	54	124
350	30000	—	—	—	—	—	—	—	—	16	47	112
350	40000									14	42	99

a. The developed length shall be measured from the vent connection to the open air.
b. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

5.16.4 **Multiple branch vents.** Where multiple branch vents are connected to a common branch vent, the common branch vent shall be sized in accordance with this section based on the size of the common horizontal drainage branch that is or would be required to serve the total drainage fixture unit (DFU) load being vented.

5.16.4.1 **Branch vents exceeding 12 m in developed length.** Branch vents exceeding 12 m in developed length shall be increased by one nominal size for the entire developed length of the vent pipe.

5.16.5 **Sump vents.** Sump vent sizes shall be determined in accordance with Sections 5.16.5.1 and 5.16.5.2.

5.16.5.1 **Sewage pumps and sewage ejectors other than pneumatic.** Drainage piping below sewer level shall be vented in a similar manner to that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 5.16.5.1.

5.16.5.2 **Pneumatic sewage ejectors.** The air pressure relief pipe from a pneumatic sewage ejector shall be connected to an independent vent stack terminating as required for vent extensions through the roof. The relief pipe shall be sized to relieve air pressure inside the ejector to atmospheric pressure, but shall not be less than 32 mm in size.

TABLE 5.16.5.1
SIZE AND LENGTH OF SUMP VENTS

DISCHARGE CAPACITY OF PUMP (ℓ/m)	MAXIMUM DEVELOPED LENGTH OF VENT (m)[a]					
	Diameter of vent (mm)					
	32	40	50	65	75	100
25	No limit [b]	No limit	No limit	No limit	No limit	No limit
50	82	No limit	No limit	No limit	No limit	No limit
150	22	49	No limit	No limit	No limit	No limit
200	10	23	82	No limit	No limit	No limit
300	5	13	45	116	No limit	No limit
400	3 [c]	8	30	76	No limit	No limit
500	Not permitted	3 [c]	14	34	113	No limit
750	Not permitted	Not permitted	6	18	64	No limit
1000	Not permitted	Not permitted	3	11	41	No limit
1200	Not permitted	Not permitted	3 [c]	7	27	116
1500	Not permitted	Not permitted	Not permitted	3 [c]	14	64
1800	Not permitted	Not permitted	Not permitted	Not permitted	8	40

a. Developed length plus an appropriate allowance for entrance losses and friction due to fittings, changes in direction and diameter. Suggested allowances shall be obtained from NSB Monograph 31 or other approved sources. An allowance of 50 percent of the developed length shall be assumed if a more precise value is not available.
b. Actual values greater than 150 m.
c. Less than 3 m.

SECTION 5.17
AIR ADMITTANCE VALVES

5.17.1 **General.** Vent systems utilizing air admittance valves shall comply with this section. Individual- and branch-type air admittance valves shall conform to ASSE 1051.

5.17.2 **Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's installation instructions. Air admittance valves shall be installed after the DWV testing required by Section 1.12.2 or 1.12.3 has

been performed.

5.17.3 **Where permitted.** Individual, branch and circuit vents shall be permitted to terminate with a connection to an air admittance valve. The air admittance valve shall only vent fixtures that are on the same floor level and connect to a horizontal branch drain. The horizontal branch drain shall conform to Section 5.17.3.1 or Section 5.17.3.2

5.17.3.1 **Location of branch.** The horizontal branch drain shall connect to the drainage stack or building drain a maximum of four branch intervals from the top of the stack.

5.17.3.2 **Relief vent.** The horizontal branch shall be provided with a relief vent that shall connect to a vent stack, or stack vent, or extend outdoors to the open air. The relief vent shall connect to the horizontal branch drain between the stack or building drain and the most downstream fixture drain connected to the horizontal branch drain. The relief vent shall be sized in accordance with Section 5.16.2 and installed in accordance with Section 5.5. The relief vent shall be permitted to serve as the vent for other fixtures.

5.17.4 **Location.** The air admittance valve shall be located a minimum of 0.1 m above the horizontal branch drain or fixture drain being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed a minimum of 0.15 m above insulation materials.

5.17.5 **Access and ventilation.** Access shall be provided to all air admittance valves. The valve shall be located within a ventilated space that allows air to enter the valve.

5.17.6 **Size.** The air admittance valve shall be rated in accordance with the standard for the size of the vent to which the valve is connected.

5.17.7 **Vent required.** Within each plumbing system, a minimum of one stack vent or vent stack shall extend outdoors to the open air.

5.17.8 **Prohibited installations.** Air admittance valves shall not be installed in non neutralized special waste systems as described in Section 4.16 and 4.17. Valves shall not be located in spaces utilized as supply or return air plenums.

SECTION 5.18
ENGINEERED VENT SYSTEMS

5.18.1 **General.** Engineered vent systems shall comply with this section and the design, submittal, approval, inspection and testing requirements of the Saudi Building Code.

5.18.2 **Individual branch fixture and individual fixture header vents.** The maximum developed length of individual fixture vents to vent branches and vent headers shall be determined in accordance with Table 5.18.2 for the minimum pipe diameters at the indicated vent airflow rates.

The individual vent airflow rate shall be determined in accordance with the following:

$$Q_{h,b} = N_{n,b} \ Q_v \qquad (5.18.1)$$

Where:

$N_{n,b}$ = Number of fixtures per header (or vent branch), total number of fixtures connected to vent stack.

$Q_{h,b}$ = Vent branch or vent header airflow rate (L/s).

Q_v = Total vent stack airflow rate (L/s).

$$= \frac{1}{3178.8} r_s^{2/3} \left(1 - r_s\right) D^{8/3}$$

Where:

D = Drainage stack diameter (mm).

Q_w = Design discharge load (L/s).

r_s = Waste water flow area to total area.

$$= \frac{3178.8\, Q_W}{D^{8/3}}$$

Individual vent airflow rates are obtained by equally distributing $Q_{h,b}$ into one-half the total number of fixtures on the branch or header for more than two fixtures; for an odd number of total fixtures, decrease by one; for one fixture, apply the full value of $Q_{h,b}$.

TABLE 5.18.2
MINIMUM DIAMETER AND MAXIMUM LENGTH OF INDIVIDUAL BRANCH FIXTURE VENTS AND INDIVIDUAL FIXTURE HEADER VENTS FOR SMOOTH PIPES

DIAMETER OF VENT PIPE (mm)	INDIVIDUAL VENT AIRFLOW RATE (L/m)																			
	Maximum developed length of vent (m)																			
	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8	5.2	5.5	5.8	6
15	2690	708	368	227	142	113	85	57	28	28	28	28	28	28	28	28	28	28	28	28
20	2831	2492	1331	849	566	425	283	255	198	170	142	113	85	85	57	57	57	57	57	28
25	—	—	2813	2662	1840	1359	1048	821	680	566	481	396	340	311	255	227	198	198	170	170
32	—	—	—	—	—	—	—	2813	2463	2067	1755	1500	1302	1133	1019	906	821	736	651	595
40	—	—	—	—	—	—	—	—	—	—	—	2813	2718	2378	2124	1840	1699	1529	1387	1274
50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2813

Individual vent developed length shall be increased by 20 percent of the distance from the vent stack to the fixture vent connection on the vent branch or header.

SECTION 5.19
COMPUTERIZED VENT DESIGN

5.19.1 **Design of vent system.** The sizing, design and layout of the vent system shall be permitted to be determined by approved computer program design methods.

5.19.2 **System capacity.** The vent system shall be based on the air capacity requirements of the drainage system under a peak load condition.

CHAPTER 6
STORM DRAINAGE SYSTEMS

SECTION 6.1
GENERAL

6.1.1 **Scope.** The provisions of this chapter shall govern the materials, design, construction and installation of storm drainage.

6.1.2 **Where required**. All roofs, paved areas, yards, courts and courtyards shall drain into a storm sewer system, or to an approved place of disposal. For one- and two-family dwellings,and where approved, storm water is permitted to discharge onto flat areas, such as streets or lawns, provided that the storm water flows away from the building.

6.1.3 **Prohibited drainage.** Storm water shall not be drained into sewers intended for sewage.

6.1.4 **Tests.** The conductors and the building storm drain shall be tested in accordance with Section 1.12.

6.1.5 **Continuous flow**. The size of a drainage pipe shall not be reduced in the direction of flow.

6.1.6 **Fittings and connections**. All connections and changes in direction of the storm drainage system shall be made with approved drainage-type fittings in accordance with Table 4.6.3. The fittings shall not obstruct or retard flow in the system.

6.1.7 **Roof design.** Roofs shall be designed for the maximum possible depth of water that will pond thereon as determined by the relative levels of roof deck and overflow weirs, scuppers, edges or serviceable drains in combination with the deflected structural elements. In determining the maximum possible depth of water, all primary roof drainage means shall be assumed to be blocked.

6.1.8 **Cleanouts required**. Cleanouts shall be installed in the storm drainage system and shall comply with the provisions of this code for sanitary drainage pipe cleanouts.
Exception: Subsurface drainage system.

6.1.9 **Backwater valves.** Backwater valves installed in a storm drainage system shall conform to Section 4.15.

SECTION 6.2
MATERIALS

6.2.1 **General.** The materials and methods utilized for the construction and installation of storm drainage systems shall comply with this section and the applicable provisions of Chapter 4.

6.2.2 **Inside storm drainage conductors.** Inside storm drainage conductors installed above ground shall conform to one of the standards listed in Table 4.2.1.

6.2.3 **Underground building storm drain pipe.** Underground building storm drain pipe shall conform to one of the standards listed in Table 4.2.2.

6.2.4 **Building storm sewer pipe**. Building storm sewer pipe shall conform to one of the standards listed in Table 6.2.4.

TABLE 6.2.4
BUILDING STORM SEWER PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2661; ASTM D2751; ASTM F 628
Cast-iron pipe	SASO 882/1994
Concrete pipe	ASTM C 14; ASTM C 76; CAN/CSA A257.1M; CAN/CSA A257.2M
Copper or copper-alloy tubing (Type K, L, M or DWV)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 306
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100)	SASO 1209/1997
Vitrified clay pipe	ASTM C 4; ASTM C700
Stainless steel drainage Systems, Type 316L	ASME A112.3.1

6.2.5 **Subsoil drain pipe**. Subsoil drains shall be open-jointed, horizontally split or perforated pipe conforming to one of the standards listed in Table 6.2.5.

TABLE 6.2.5
SUBSOIL DRAIN PIPE

MATERIAL	STANDARD
Cast-iron pipe	SASO 882/1994
Polyethylene (PE) plastic pipe	ASTM F 405
Polyvinyl chloride (PVC) Plastic pipe (type sewer pipe, PS25, PS50 or PS100)	ASTM D 2729; ASTM F 891; CSA-B 182.2;CAN/CSA-B182.4
Vitrified clay pipe	ASTM C 4; ASTM C700
Stainless steel drainage Systems, Type 316L	ASME A112.3.1

6.2.6 **Roof drains.** Roof drains shall conform to ASME A9.2.21.2M or ASME A9.2.3.1

6.2.7 **Fittings.** Pipe fittings shall be approved for installation with the piping material installed, and shall conform to the respective pipe standards or one of the standards listed in Table 6.2.7. The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.

TABLE 6.2.7
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic	ASTM D 2468; ASTM D 2661
Cast-iron	ASME B 16.4; ASME B 16.12; ASTM A 888; CISPI 301; ASTM A 74
Chlorinated polyvinyl chloride (CPVC) plastic	ASTM F 437; ASTM F 438; ASTM F 439
Copper or copper alloy	ASME B 16.15; ASME B 16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29
Gray iron and ductile iron	AWWA C110
Malleable iron	ASME B16.3.
Plastic, general	ASTM F 409
Polyethylene (PE) plastic	ASTM D 2609
Polyvinyl chloride (PVC) plastic	ASTM D 2464; ASTM D 2466; ASTM D 2467; CSA-B137.2; ASTM D 2665; ASTM F 1866
Steel	ASME B16.9; ASME B16.11; ASME B16.28
Stainless steel drainage systems, Type 316L	ASME A 112.3.1

SECTION 6.3
TRAPS

6.3.1 **Main trap.** Leaders and storm drains connected to a combined sewer shall be trapped. Individual storm water traps shall be installed on the storm water drain branch serving each conductor, or a single trap shall be installed in the main storm drain just before its connection with the combined building sewer or the public sewer.

6.3.2 **Material.** Storm water traps shall be of the same material as the piping system to which they are attached.

6.3.3 **Size.** Traps for individual conductors shall be the same size as the horizontal drain to which they are connected.

6.3.4 **Cleanout.** An accessible cleanout shall be installed on the building side of the trap.

SECTION 6.4
CONDUCTORS AND CONNECTIONS

6.4.1 **Prohibited use.** Conductor pipes shall not be used as soil, waste or vent pipes, and soil, waste or vent pipes shall not be used as conductors.

6.4.2 **Combining storm with sanitary drainage.** The sanitary and storm drainage systems of a structure shall be entirely separate except where combined sewer systems are utilized. Where a combined sewer is utilized, the building storm drain shall be connected in the same horizontal plane through a single-wye fitting to the combined sewer at least 3 m downstream from any soil stack.

6.4.3 **Floor drains.** Floor drains shall not be connected to a storm drain.

SECTION 6.5
ROOF DRAINS

6.5.1 **Strainers.** Roof drains shall have strainers extending not less than 100 mm above the surface of the roof immediately adjacent to the roof drain. Strainers shall have an available inlet area, above roof level, of not less than one and one-half times the area of the conductor or leader to which the drain is connected.

6.5.2 **Flat decks.** Roof drain strainers for use on sun decks, parking decks and similar areas that are normally serviced and maintained shall comply with Section 6.5.1 or shall be of the flat-surface type, installed level with the deck, with an available inlet area not less than two times the area of the conductor or leader to which the drain is connected.

6.5.3 **Roof drain flashings.** The connection between roofs and roof drains which pass through the roof and into the interior of the building shall be made water tight by the use of approved flashing material.

SECTION 6.6
SIZE OF CONDUCTORS, LEADERS AND STORM DRAINS

6.6.1 **General.** The size of the vertical conductors and leaders, building storm drains, building storm sewers, and any horizontal branches of such drains or sewers shall be based on rainfall rates determined from approved local weather data.

6.6.2 **Vertical conductors and leaders.** Vertical conductors and leaders shall be sized for the maximum projected roof area, in accordance with Table 6.6.2.

TABLE 6.6.2
SIZE OF VERTICAL CONDUCTORS AND LEADERS

DIAMETER OF LEADER (mm)[a]	HORIZONTALLY PROJECTED ROOF AREA (square meters)											
	Rainfall rate (mm per hour)[b]											
	25	50	75	100	125	150	175	200	225	250	275	300
50	270	135	90	67	53	45	38	33	30	27	24	22
80	818	409	272	204	164	137	117	102	91	82	74	68
100	1709	855	569	427	342	285	244	214	190	171	156	142
125	3214	1607	1071	804	643	536	459	402	357	321	292	268
150	5017	2508	1672	1254	1003	836	717	627	557	502	456	418
200	10776	5388	3592	2694	2155	1794	1539	1347	1197	1078	980	892

a. Sizes indicated are the diameter of circular piping. This table is applicable to piping of other shapes provided the cross-sectional shape fully encloses a circle of the diameter indicated in this table.
b. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from SASO standards or pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

6.6.3 **Building storm drains and sewers.** The size of the building storm drain, building storm sewer and their horizontal branches having a slope of 4-percent slope shall be based on the maximum projected roof area in accordance with Table 6.6.3. The

minimum slope of horizontal branches shall be 1-percent slope unless otherwise approved.

TABLE 6.6.3
SIZE OF HORIZONTAL STORM DRAINGE PIPING

SIZE OF HORIZONTAL PIPING[a] (mm)	HORIZONTALLY PROJECTED ROOF AREA (square meters)					
	Rainfall rate (mm per hour)					
	25	50	75	100	125	150
1-percent slope						
80	305	155	100	75	60	50
100	700	350	135	165	140	115
125	1240	620	415	310	250	205
150	1990	995	665	495	400	330
200	4275	2135	1425	1070	855	705
250	7690	3845	2565	1925	1540	1280
00	12375	6185	4125	3095	2475	2060
350	20250	10125	6765	5530	4420	3685
2-percent slope						
80	430	215	145	110	85	70
100	985	490	330	245	195	165
125	1755	875	585	440	350	290
150	2805	1405	935	700	560	470
200	6055	3030	2020	1515	1210	1010
250	10850	5425	3620	2715	2170	1805
300	17465	8735	5815	4365	3495	2910
350	31215	15605	10405	7805	6250	5200
4-percent slope						
80	610	305	215	155	120	100
100	1395	700	465	350	280	230
125	2480	1240	825	620	495	415
150	3975	1990	1275	995	795	665
200	8545	4275	2845	2135	1710	1425
250	15940	7970	5130	3845	3080	2565
300	24750	12375	8250	6185	4940	4125
350	44220	22110	14755	11055	8855	7360

a. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from SASO standards or pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

6.6.4 **Vertical walls.** In sizing roof drains and storm drainage piping, one-half of the area of any vertical wall that diverts rainwater to the roof shall be added to the projected roof area for inclusion in calculating the required size of vertical conductors, leaders and horizontal storm drainage piping.

6.6.5 **Parapet wall scupper location.** Parapet wall roof drainage scupper and overflow scupper location shall comply with the Saudi Building Code Architectural Requirements SBC 201.

6.6.6 **Size of roof gutters.** The size of semicircular gutters shall be based on the maximum projected roof area in accordance with Table 6.6.6.

TABLE 6.6.6
SIZE OF SEMICIRCULAR ROOF GUTTERS

DIAMETER OF GUTTERS[a] (mm)	HORIZONTALLY PROJECTED ROOF AREA (square meters) Rainfall rate (mm per hour)					
	25	50	75	100	125	150
0.5-percent slope						
80	65	30	20	15	15	10
100	135	65	45	35	25	20
125	230	115	75	60	45	40
150	355	180	120	90	70	60
175	515	255	170	130	100	85
200	740	370	245	185	150	125
250	1340	670	445	335	270	225
1-percent slope						
80	90	45	30	20	20	15
100	190	95	65	45	40	30
125	325	165	110	80	65	55
150	505	255	170	125	100	85
175	725	360	240	180	145	120
200	1040	520	345	260	210	175
250	1895	950	630	475	380	315
2-percent slope						
80	125	65	40	30	25	20
100	270	135	90	65	55	45
125	465	230	155	115	95	75
150	715	355	240	180	145	120
175	1025	515	360	255	205	170
200	1480	740	495	370	295	245
250	2675	1340	890	670	535	445
4-percent slope						
80	180	90	60	45	35	30
100	380	190	125	95	75	65
125	660	330	220	165	130	110
150	1030	515	345	255	205	170
175	1450	725	485	360	290	240
200	2080	1040	695	520	415	345
250	3715	1860	1240	930	745	620

a. Shown sizes are nominal sizes based on internal diameters. If the pipe nominal size is based on the external diameter, find the internal diameter (from SASO standards or pipe's manufacturer) and use a pipe size with an internal diameter equal to or greater than the size shown in the table.

SECTION 6.7
SECONDARY (EMERGENCY) ROOF DRAINS

6.7.1 **Secondary drainage required.** Secondary (emergency) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason.

6.7.2 **Separate systems required.** Secondary roof drain systems shall have the end point of discharge separate from the primary system. Discharge shall be above grade, in a location which would normally be observed by the building occupants or maintenance personnel.

6.7.3 **Sizing of secondary drains.** Secondary (emergency) roof drain systems shall be sized in accordance with Section 6.6 based on the rainfall rate for which the primary system is sized in Tables 6.6.2, 6.6.3 and 6.6.6. Scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 6.1.7. Scuppers shall not have an opening dimension of less than 100 mm. The flow through the primary system shall not be considered when sizing the secondary roof drain system.

SECTION 6.8
COMBINED SANITARY AND STORM SYSTEM

6.8.1 **Size of combined drains and sewers.** The size of a combination sanitary and storm drain or sewer shall be computed in accordance with the method in section 6.6.3. The fixture units shall be converted into an equivalent projected roof or paved area. Where the total fixture load on the combined drain is less than or equal to 256 fixture units, the equivalent drainage area in horizontal projection shall be taken as 372 m^2. Where the total fixture load exceeds 256 fixture units, each additional fixture unit shall be considered the equivalent of 1.5 m^2 of drainage area. These values are based on a rainfall rate of 25 mm per hour.

SECTION 6.9
VALUES FOR CONTINUOUS FLOW

6.9.1 **Equivalent roof area**. Where there is a continuous or semicontinuous discharge into the building storm drain or building storm sewer, such as from a pump, ejector, air conditioning plant or similar device, each ℓ/m of such discharge shall be computed as being equivalent to 9 m^2 of roof area, based on a rainfall rate of 25 mm per hour.

SECTION 6.10
CONTROLLED FLOW ROOF DRAIN SYSTEMS

6.10.1 **General**. The roof of a structure shall be designed for the storage of water where the storm drainage system is engineered for controlled flow. The controlled flow roof drain system shall be an engineered system in accordance with this section and the design, submittal, approval, inspection and testing requirements of the Saudi Building Code Regulation SBC 100. The controlled flow system shall be designed based on the required rainfall rate in accordance with Section 6.6.1.

6.10.2 **Control devices.** The control devices shall be installed so that the rate of discharge of water per minute shall not exceed the values for continuous flow as indicated in section 6.9.1.

6.10.3 **Installation.** Runoff control shall be by control devices. Control devices shall be protected by strainers.

6.10.4 **Minimum number of roof drains.** Not less than two roof drains shall be installed in roof areas 930 m^2 or less and not less than four roof drains shall be installed in roofs over 930 m^2 in area.

SECTION 6.11
SUBSOIL DRAINS

6.11.1 **Subsoil drains.** Subsoil drains shall be open-jointed, horizontally split or perforated pipe conforming to one of the standards listed in table 6.2.5. Such drains shall not be less than 100 mm in diameter. Where the building is subject to backwater, the subsoil drain shall be protected by an accessibly located backwater valve. Subsoil drains shall discharge to a trapped area drain, sump, dry well or approved location above ground. The subsoil sump shall not be required to have either a gas-tight cover or a vent. The sump and pumping system shall comply with Section 6.13.1.

SECTION 6.12
BUILDING SUBDRAINS

6.12.1 **Building subdrains.** Building subdrains located below the public sewer level shall discharge into a sump or receiving tank, the contents of which shall be automatically lifted and discharged into the drainage system as required for building sumps. The sump and pumping equipment shall comply with Section 6.13.1.

SECTION 6.13
SUMPS AND PUMPING SYSTEMS

6.13.1 **Pumping system.** The sump pump, pit and discharge piping shall conform to Sections 6.13.1.1 through 6.13.1.4.

6.13.1.1 **Pump capacity and head.** The sump pump shall be of a capacity and head appropriate to anticipated use requirements.

6.13.1.2 **Sump pit.** The sump pit shall not be less than 450 mm in diameter and 0.6 m deep, unless otherwise approved. The pit shall be accessible and located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, steel, plastic, cast-iron, concrete or other approved material, with a removable cover adequate to support anticipated loads in the area of use. The pit floor shall be solid and provide permanent support for the pump.

6.13.1.3 **Electrical.** Electrical service outlets, when required, shall meet the Saudi Building Code Electrical requirements SBC 401.

6.13.1.4 **Piping.** Discharge piping shall meet the requirements of Section 6.2.2, 6.2.3 or 6.2.4 and shall include a gate valve and a full flow check valve. Pipe and fittings shall be the same size as, or larger than, pump discharge tapping.

Exception: In one- and two-family dwellings, only a check valve shall be required, located on the discharge piping from the pump or ejector.

CHAPTER 7
PRIVATE SEWAGE DISPOSAL SYSTEMS

SECTION 7.1
GENERAL

7.1.1 **Scope**. The provisions of this chapter shall govern the general regulations of private sewage disposal systems, including specific limitations and flood hazard areas.

7.1.2 **Specific limitations.**

7.1.2.1 **Domestic waste.** All wastes and sewage derived from ordinary living uses shall enter the septic tank, treatment tank, or cesspool unless otherwise specifically exempt by the code official or these requirements SBC 701.

7.1.2.2 **Cesspools and Privies.** Privies shall be prohibited. Cesspools shall be prohibited, except where approved by the code official. Where approved, cesspools shall be designed and installed in accordance with Section 7.6.

7.1.2.3 **Industrial wastes.** The code official shall approve the method of treatment and disposal of all waste products from manufacturing or industrial operations, including combined industrial and domestic waste.

7.1.2.4 **Detrimental or dangerous waste.** Material such as ashes, cinders or rags; flammable, poisonous or explosive liquids or gases; oil, grease or other insoluble material that is capable of obstructing, damaging, or overloading the private sewage disposal system, or is capable of interfering with the normal operation of the private sewage disposal system, shall not be deposited, by any means, into such systems. The code official shall approve the method of treatment and disposal.

7.1.2.5 **Clear water.** The discharge of surface, rain or other clear water into a private sewage disposal system shall be prohibited.

7.1.2.6 **Water softener and iron filter backwash.** Water softener or iron filter discharge shall be direct to the private sewage disposal system or the ground surface, provided a nuisance is not created.

7.1.3 **Flood hazard areas.**

7.1.3.1 **General.** Soil absorption systems shall be located outside of flood hazard areas.
Exception: Where suitable soil absorption sites outside of the flood hazard area are not available, the soil absorption site is permitted to be located within the flood hazard area. The soil absorption site shall be located to minimize the effects of inundation under conditions of the design flood.

7.1.3.2 **Tanks**. In flood hazard areas, tanks shall be anchored to counter buoyant forces during condition of the design flood. The vent termination and service manhole of the tank shall be a minimum of 0.65 m above the design flood elevation or fitted with covers designed to prevent the inflow of floodwater or outflow of the contents of the tanks during conditions of the design flood.

SECTION 7.2
SITE EVALUATION AND REQUIREMENTS

7.2.1 **Scope**. The provisions of this chapter shall govern the evaluation of and requirements for private sewage disposal system sites.

7.2.2 **Site evaluation.** Site evaluation shall include soil conditions, properties and permeability, depth to zones of soil saturation, depth to bedrock, slope, landscape

position, all setback requirements and the presence of flood hazard areas. Soil test data shall relate to the undisturbed elevations, and a vertical elevation reference point or benchmark shall be established. Evaluation data shall be reported on approved forms. Reports shall be filed for all sites investigated within 30 days of the completion of testing.

7.2.3 **Replacement system area.** On each parcel of land being initially developed, sufficient area of suitable soils-based on the soil tests and system location and site requirements of these requirements SBC 701 for one replacement system shall be established. Where bore whole test data in the replacement system area are equivalent to data in the proposed system area, the percolation test is not required.

7.2.3.1 **Nonconforming site conditions.** Where site conditions do not permit replacement systems in accordance with these requirements SBC 701 and an alternative system is utilized, the alternative system shall be approved in accordance with the Saudi Building Code Regulations SBC 100.

7.2.3.2 **Undisturbed site.** The replacement system shall not be disturbed to the extent that the site area is no longer suitable. The replacement system area shall not be used for construction of buildings, parking lots or parking areas, below-ground swimming pools or any other use that will adversely affect the replacement area.

7.2.4 **Slope.** A conventional soil absorption system shall not be located on land with a slope greater than 20 percent. A conventional soil absorption system shall be located a minimum of 6 m from the crown of land with a slope greater than 20 percent, except where the top of the aggregate of system is at or below the bottom of an adjacent roadside ditch. Where a more restrictive land slope is to be observed for a soil absorption system, other than a conventional soil absorption system, the more restrictive land slope specified in the design sections of these requirements SBC 701 shall apply.

7.2.5 **Soil borings and profile descriptions.** Soil borings shall be conducted on all sited, regardless of the type of private sewage system planned to serve the parcel. Borings shall extend at least 1 m below the bottom of the proposed system. Borings shall be of sufficient size and extent to determine the soil characteristics important to an on-site liquid waste disposal system. Borehole data shall be used to determine the suitability of soils at the site with respect to zones of seasonal or permanent soil saturation and the depth to bedrock. Borings shall be conducted prior to percolation tests to determine whether the soils are suitable to warrant such tests and, if suitable, at what depth percolation tests shall be conducted. The use of power augers for soil borings shall be prohibited. Soil borings shall be conducted and reported in accordance with Sections 7.2.5.1 through 7.2.5.5 where it is not practical to have borings made with a backhoe; such borings shall be augured or dug by hand.

7.2.5.1 **Number.** There shall be a minimum of three borings per soil absorption site. Where necessary, more soil borings shall be made for an accurate evaluation of a site. Borings shall be constructed to a depth of at 1 m below the proposed depth of the system.

7.2.5.2 **Location.** Each borehole shall be accurately located to the vertical elevation and horizontal reference points. Reports of boring location shall either be dawn to scale or have the horizontal dimensions clearly indicated between the borings and the horizontal reference point.

7.2.5.3 **Soil description.** Soil profile descriptions shall be written for all borings. The thickness in mm of the different soil horizons observed shall be indicated: Horizons shall be differentiated on the basis of color, texture, soil mottles or

bedrock. Depths shall be measured from the ground surface.

7.2.5.4 **Soil mottles.** Seasonal or periodic soil saturation zones shall be estimated at the highest level of soil mottles. The code official shall require, where deemed necessary, a detailed description of the soil mottling on a marginal site. The abundance, size, contrast and color of the soil mottles shall be described in the following manner:

Abundance shall be described as "few" if the mottled color occupies less than 2 percent of the exposed surface, "common" if the mottled color occupies from 2 to 20 percent of the exposed surface, or "many" if the mottled color occupies more than 20 percent of the exposed surface. Size refers to length of the mottle measured along the longest dimension and shall be described as "fine" if the mottle is less than 5 mm, medium if the mottle is from 5 mm to 15 mm, or coarse if the mottle is greater than 15 mm. Contrast refers to the difference in color between the soil mottle and the background color of the soil and is described as "faint" if the mottle is evident but recognizable with close examination; "distinct" if the mottle is readily seen but not striking; or "prominent" if the mottle is obvious and one of the outstanding features of the horizon. The color(s) of the mottle(s) shall be indicated.

7.2.5.5 **Observed ground water.** The depth to ground water, if present, shall be reported. Observed ground water shall be reported at the level that ground water reaches in the soil borehole or the highest level of sidewall seepage into the boring. Measurements shall be made from ground level. Soil located above the water level in the boring shall be checked for the presence of soil mottles.

7.2.6 **Color patterns not indicative of soil saturation.** The following soil conditions shall be reported, but shall not be interpreted as color patterns due to wetness or saturation. Soil profiles with an abrupt textural change with finer-textured soils overlying more than 1.2 m of un-mottled, loamy sand or coarser soils can have a mottled zone for the finer textured material. Where the mottled zone is less than 0.3 m thick and located immediately above the textural change, a soil absorption system shall be permitted in the loamy sand or coarser material below the mottled layer. The site shall be considered unsuitable where any soil mottles occur within the sandy material. The code official shall consider certain coarse sandy loan soils to be included as a coarse material.

7.2.6.1 **Other soil color patterns.** Soil Mottles occur that are not due to seasonal or periodic soil saturation zones. Examples of such soil conditions not limited by enumeration are soil mottles formed from residual sandstone deposits; soil mottles formed from uneven weathering of glacially deposited material or glacially deposited material that is naturally gray in color, including any concretionary material in various stages of decomposition; deposits of lime in a profile derived from highly calcareous parent material; light-colored silt coats deposited on soil bed faces; and soil mottles usually vertically oriented along old or decayed root channels with a dark organic stain usually present in the center of the mottled area.

7.2.6.2 **Reporting exceptions.** The site evaluator shall report any mottled soil condition. The observation of soil mottles not due to soil saturation shall be reported. Upon request, the code official shall make a determination of the acceptability of the site.

7.2.7 **Bedrock.** The depth of the bedrock, except sandstone, shall be established at the depth in a soil boring where greater than 50 percent of the weathered-in-place material is consolidated. Sandstone bedrock shall be established at the depth where an increase in resistance to penetration of a knife blade occurs.

7.2.8 **Alluvial and collegial deposits.** Subsurface soil absorption systems shall not be

placed in alluvial and collegial deposits with shallow depths, extended periods of saturation or possible flooding.

7.2.9 **Soil permeability.** The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

7.2.10 **Percolation tests and procedures.** At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the button depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

7.2.10.1 **Percolation test hole.** The test hole shall be dug or bored. The test hole shall have vertical sides and horizontal dimension of 100 mm to 200 mm. The bottom and sides of the hole shall be scratched with a sharp pointed instrument to expose the natural soil. All loose material shall be removed from the hole, and the bottom shall be covered with 50 mm of gravel or coarse sand.

7.2.10.2 **Test procedure, sandy soils.** The hole shall be filled with clear water to a minimum of 300 mm above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 0.15 m above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for period of 1 hour. Where 0.15 m of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 0.15 m. Where 0.15 m of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 7 s/mm shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 7.2.10.3.

7.2.10.3 **Test procedure, other soils.** The hole shall be filled with clear water, and a minimum water depth of 0.3 m shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: Any soil sloughed into the hole shall be removed, and the water level shall be adjusted to 0.15 m above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than 1.6 mm. At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 0.15 m above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 0.15 m of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 0.13 m at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

7.2.10.4 **Mechanical test equipment.** Mechanical percolation test equipment shall be of an approved type.

7.2.11 **Permeability evaluation.** Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices.

Borings shall be made in accordance with Section 7.2.10 for evaluating the soil.

7.2.12 **Soil verification**. Where required by the code official, depth to bedrock and land slope shall be verified by the code official. The code official shall require, where necessary, backshore pits to be provided for verification of soil boring data. Where required by the code official, the results of percolation tests or permeability evaluation shall be subject to verification. The code official shall require, where necessary, that percolation tests be conducted under supervision. Where the natural soil condition has been altered by filling or other methods used to improve wet areas, the code official shall require, where necessary, observation of high ground water levels under saturated soil conditions. Detailed soil maps, or other adequate information, shall be used for determining estimated percolation rates and other soil characteristics.

7.2.13 **Monitoring ground water levels**. A property owner or developer shall have the option to provide documentation that soil mottling or other color patterns at a particular site are not an indication of seasonally saturated soil conditions of high ground water levels. Documentation shall be made by direct observation of ground water levels.

7.2.14 **Soil absorption site location.** The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any nearby water well or reservoir on the same or adjoining property. Where is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 7.2.14. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

7.2.14.1 **Flood hazard areas.** The site shall be located outside of flood hazard areas.

Exception: Where suitable sites outside of the flood hazard area are not available, it is permitted for the site to be located within the flood hazard area. The site shall be located to minimize the effects of inundation under condition of the design flood.

TABLE 7.2.14
MINIMUM HORIZONAL SEPARATION DISTANCES
FOR SOIL ABSORPTION SYSTEMS

ELEMENT	DISTANCE (m)
Cistern	15
Habitable building. Below-grade foundation	7.5
Habitable building, slab-on-grade	4.5
Lake, high-water mark	15
Lot line	1.5
Reservoir	15
Roadway ditches	3
Spring	30
Streams or wadi	15
Swimming pool	4.5
Uninhabited building	3
Water main	15
Water service	3
Water well	15

7.2.15 **Ground water, bedrock or slowly permeable soils.** There shall be a minimum of 1 m of soil between the bottom of the soil absorption system and high ground water or bedrock. Soil with a percolation rate of 60 minutes per 25 mm or faster shall exist for the depth of the proposed soil absorption system and at least 1 m below the proposed bottom of the soil absorption system. There shall be 1.5 m of suitable soil from original grade for a conventional soil absorption system.

7.2.16 **Percolation rate, trench or bed.** A subsurface soil absorption system of the trench or bed type shall not be installed where the percolation rate for any one of the three tests is slower than 60 minutes for water to fall 25 mm. The slowest percolation rate shall be used to determine the absorption area.

7.2.17 **Percolation rate, seepage pit.** Percolation tests shall be made in each horizon penetrated below the inlet pipe for a seepage pit. Soil strata in which the percolation rates are slower than 30 minutes 25 mm shall not be included in computing the absorption area. The slowest percolation rate shall be used to determine the absorption area.

7.2.18 **Soil maps.** When a parcel of land consists entirely of soils with very severe or severe limitations for on-site liquid-waste disposal as determined by use of a detailed soil map and supporting data, that map and supporting data shall be permitted to be used as a basis for denial for an on-site waste disposal system. However, the property owner shall be permitted to present evidence that a suitable site for an on-site liquid-waste disposal system does exist.

7.2.19 **Filled area.** A soil absorption system shall not be installed in a filled area unless written approval is received.

7.2.19.1 **Placement of fill.** The approval of a conventional soil absorption system shall be based on evidence indicating its conformance to the Saudi Building Code Structural Requirements – Soil and Foundations SBC 303, requirements for area, percolation and elevation.

7.2.19.2 **Bedrock.** Sites with less than 1.5 m but at least 0.75 m of soil over bedrock, where the original soil texture is sand or loamy sand, are permitted to be filled with the same soil texture as the natural soil or coarser material up to and including medium sand to overcome the site limitations. The fill material shall not be of a finer texture than the natural soil.

7.2.19.3 **High ground water.** Slits with less than 1.5 m of soil over high ground water or estimated high ground water, where the original soil texture is sand or loamy sand, are permitted to be filled in accordance with Section 7.2.19.1 or 7.2.19.2.

7.2.19.4 **Natural soil.** Sites with soil finer than sand or loamy sand shall not be approved for systems in fill.

7.2.19.5 **Monitoring.** Sites that will have 0.75 m or less of soil above high ground water after the topsoil is removed shall be monitored for high ground water levels in the filled area in accordance with Section 7.2.13.

7.2.19.6 **Inspection of fill.** Placement of the fill material shall be inspected by the code official.

7.2.19.7 **Design requirements.** Filled areas shall b large enough to accommodate a shallow trench system and a replacement system. The site of the area to be filled shall be determined by the percolation rate of the natural soil and use of the building. Where any portion of the trench system or its replacement is in the fill, the fill shall extend 6 m beyond all sides of both systems before the slope begins. Soil borings and percolation tests shall be conducted before filling to determine soil

textures and depth to high ground water or bedrock. Vegetation and topsoil shall be removed prior to filling. Slopes at the edge of the filled areas shall have a maximum ration of one unit vertical to three units horizontal (33-percent slope), provided the 6 m separating distance is maintained.

7.2.20 **Altering slope.** Areas with slopes exceeding those specified in Section 7.2.4 shall not be utilized unless graded and reshaped in accordance with Sections 7.2.20.1 through 7.2.20.3.

7.2.20.1 **Site investigation.** Soil test data shall show that a sufficient depth of suitable soil material is present to provide the required amount of soil over bedrock and ground water after alteration. A complete site evaluation as specified in this section shall be performed after alteration of the site.

7.2.20.2 **System location.** A soil absorption system shall be installed in the cut area of an altered site. A soil absorption system shall not be installed in the fill area of an altered site. The area of fill on an altered site is permitted to be used as a portion of the required 6 m separating distance from the crown of a critical slope. There shall be a minimum of 2 m of natural soil between the edge of a system area and the down slope side of the altered area.

7.2.20.3 **Site protection.** All altered slope areas shall be positioned so that surface water drainage will be diverted away from the system areas. All disturbed areas shall be seeded or sodded with grass, and appropriate steps shall be taken to control erosion (see Figure 7.2.20.3).

SECTION 7.3
MATERIALS

7.3.1 **Scope.** The provisions of this chapter shall govern the requirements for materials for private sewage disposal systems.

7.3.2 **Minimum standards.** Materials shall conform to the standards referenced in these requirements SBC 701 for the construction, installation, alteration or repair of private sewage disposal systems or parts thereof.

Exception: The extension, addition to or relocation of existing pipes with materials of like grade or quality in accordance with the Saudi Building Code Regulations SBC 100.

7.3.3 **Identification.** The manufacturer's mark or name and the quality of the product or identification shall be cast, embossed, stamped or indelibly marked on each length of pipe and each pipe fitting, fixture, tank, material and device utilized in a private sewage disposal system in accordance with the approved standard. Tanks shall indicate their capacity.

7.3.4 **Approved materials required.** All materials, fixtures or equipment used in the installation, repair or alteration, repair or alteration of any private sewage disposal system shall conform to the standards referenced in these requirements SBC 701, except as otherwise approved in accordance with the Saudi Building Code Regulations SBC 100.

7.3.5 **Care in installation.** All materials installed in private sewage disposal systems shall be handled and installed so as to avoid damage. The quality of the material shall not be impaired.

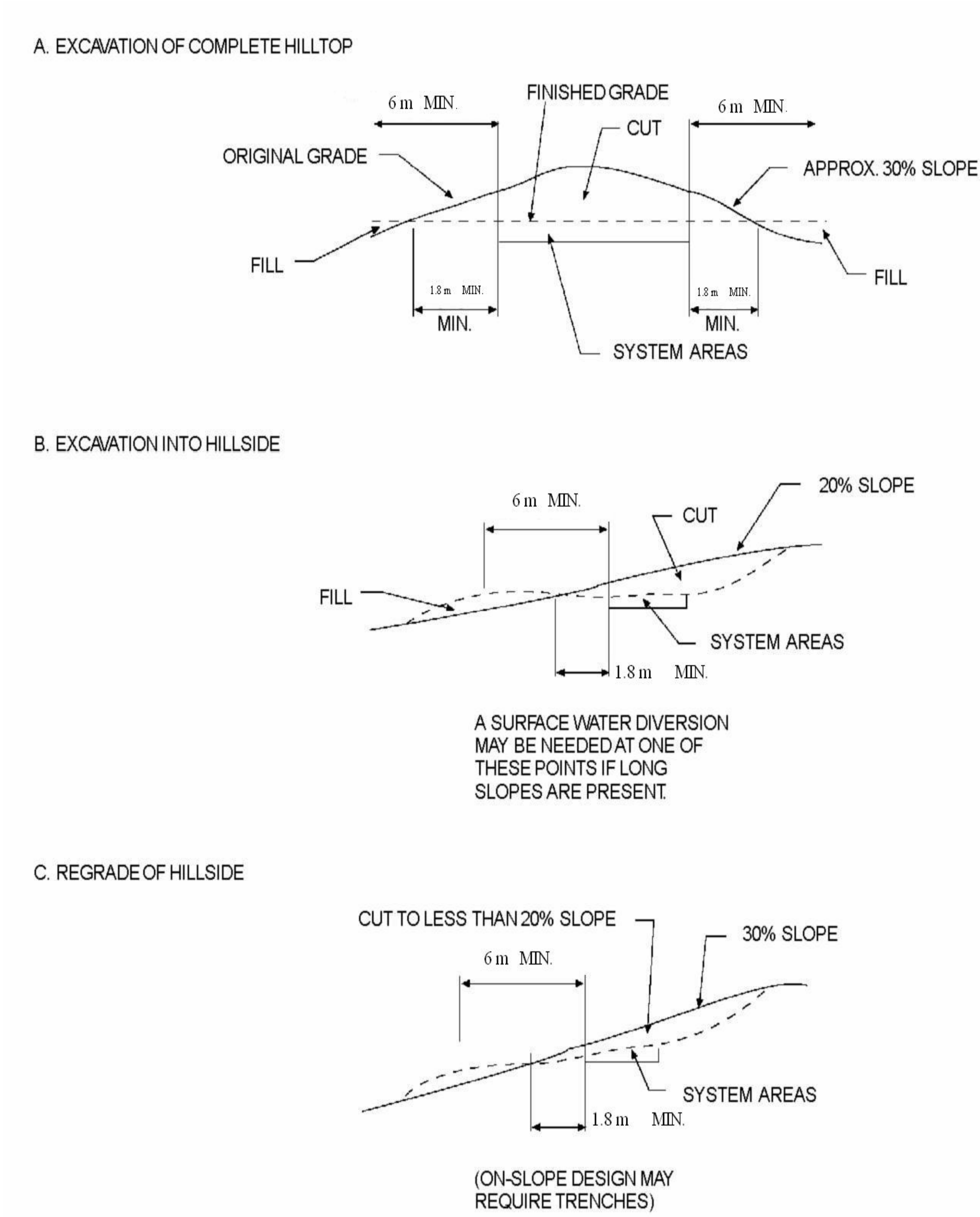


FIGURE 7.2.20.3
CONCEPTUAL DESIGN SKETCH FOR ALTERING SLOPES

7.3.6 **Defective materials prohibited.** Defective or damaged materials, equipment or apparatus shall not be installed or maintained.

7.3.7 **Approved tanks.** All tanks shall be of an approved type. The design of tanks shall conform to the requirements of Section 7.5. All tanks shall be designed to withstand the pressures to which they are subjected.

7.3.8 **Precast concrete and site-constructed tanks.** Precast concrete tanks shall conform to ASTM C 913. The floor and sidewalls of a site-constructed concrete tank shall be monolithic, except a construction joint is permitted in the lower 0.30 m of the sidewalls of the tank. The construction joint shall have a keyway in the lower section of the joint. The width of the keyway shall be approximately 30 percent of the thickness of the sidewall with a depth equal to the width. A continuous water stop or baffle at least 1.4 m wide shall be set vertically in the joint, embedded one-half its width in the concrete below the joint with the remaining width in the concrete above the joint. The water stop or baffle shall be copper, neoprene, rubber or polyvinyl chloride designed for this specific purpose. Joints between the concrete septic tank and the tank cover and between the septic tank cover and manhole riser shall be tongue and groove or shiplap-type and sealed water tight using cement, mortar or bituminous compound.

7.3.9 **Steel tanks.** Steel tanks shall conform to UL 70. Any damage to the bituminous coating shall be repaired by recoating. The thickness of the steel shall be in accordance with Table 7.3.9.

TABLE 7.3.9
TANK CAPACITY

TANK DESIGN AND CAPACITY		**MINIMUM THICKNESS (mm)**	**MINIMUM DIAMETER (m)**
Vertical cylindrical			
2.0-4.0 m^3	Bottom and Sidewalls	2.5	None
	Cover	2.5	
	Baffles	2.5	
4.1-5.0 m^3	Complete tank	3.5	None
5.1-6.0 m^3	Complete tank	5.0	None
Horizontal cylindrical			
2.0-4.0 m^3	Complete tank	2.5	1.4
4.1-6.0 m^3	Complete tank	2.5	1.6
6.1-9.5 m^3	Complete tank	3.5	2.0
9.51-34 m^3	Complete tank	2.5	2.0
34.1-45.5 m^3	Complete tank	6 mm plate	None
>45.5 m^3	Complete tank	8 mm	None

7.3.10 **Fiberglass tanks.** Fiberglass tanks shall conform to ASTM D 4021.

7.3.11 **Manholes.** Manhole collars and extensions shall be of the same material as the tank. Manhole covers shall be of concrete, steel, cast iron or other approved material.

7.3.12 **Pipe.** Pipe for private sewage disposal systems shall have a smooth wall and conform to one of the standards listed in Table 7.3.12.

7.3.12.1 **Distribution Pipe.** Perforated pipe for distribution systems shall conform to one of the standards listed in Table 7.3.12 or 7.3.12.1.

TABLE 7.3.12
PRIVATE SEWAGE DISPOSAL SYSTEM PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D 2662; ASTM D 2751; ASTM F 628
Cast-iron pipe	ASTM A 74; ASTM A 888; CISPI 301
Coextruded composite ABS DWV Schedule 40 IPS pipe (solid)	ASTM F 1488; ASTM F 1499
Coextruded composite ABS DWV Schedule 40 IPS pipe (Cellular core)	ASTM F 1488; ASTM F 1499
Coextruded composite ABS sewer and drain DR-PS in PS35, PS50, PS100, PS140 and PS200	ASTM F 1488; ASTM F 1499
Coextruded composite PVC DWV Schedule 40 IPS pipe (solid)	ASTM F 1488
Coextruded composite PVC DWV Schedule 40 IPS pipe (Cellular core)	ASTM F 1488
Coextruded composite PVC-IPS-DR of PS140, PS200, DWV	ASTM F 1488
Coextruded composite PVC 3.25 OD DWV pipe	ASTM F 1488
Coextruded composite PVC sewer and drain DR-PS in PS35, PS50, PS100, PS140 and PS200	ASTM F 1488
Concrete pipe	ASTM C 14; ASTM C 76; CAN/CSA A257.IM; CAN/CSA A257.2M
Copper or copper-alloy tubing Type K or L)	ASTM B 75; ASTM B 88; ASTM B 251
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100)	ASTM D 2665; ASTM D 2949; ASTM D 3034; ASTM F 891; CSA B182.2; CAN/CSA B182.4
Vitrified clay pipe	ASTM C 4; ASTM C 700

TABLE 7.3.12.1
DISTRIBUTION PIPE

MATERIAL	STANDARD
Polyethylene (PE) plastic pipe	ASTM F 405
Polyethyl chloride (PVC) plastic pipe	ASTM D 2729
Polyethyl chloride (PVC) plastic pipe With pipe stiffness of PS35 and PS50	ASTM F 1488

7.3.13 **Joints and connection approval.** All joints and connections shall be of an approved type.

7.3.14 **ABS plastic pipe.** Joints between acrylonitrile butadiene styrene (ABS) plastic pipe or fittings shall be in accordance with Sections 7.3.14.1 and 7.3.14.2.

7.3.14.1 **Mechanical joints.** Mechanical joints shall be made with an electrometric seal conforming to ASTM C 1173, ASTM D 3212 or CAN/CSA-B602. Joints shall be installed in accordance with the manufacturer's instructions.

7.3.14.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. Solvent cement conforming to ASTM D 2235 or CSA B181.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet. Joints shall be made in accordance with ASTM D 2235, ASTM D 2661, ASTM F 628 or CSA B181.1.

7.3.15 **Bituminized fiber pipe.** Joints between bituminized fiber pipe or fittings shall be made with tapered-type couplings of the same material.

7.3.16 **Cast-iron pipe.** Joints between cast-iron pipe or fittings shall be in accordance with Sections 7.3.16.1 through 7.3.16.3.

7.3.16.1 **Caulked joints.** Joints for hub and spigot pipe shall be firmly packed with oakum or hemp. Molten lead shall be poured in one operation to a depth of not less than 25 mm. The lead shall not recede more than 3.2 mm below the rim of the hub, and shall be caulked tight. Paint, varnish or other coatings shall not be applied to the joining material until after the joint has been tested and approved.

7.3.16.2 **Mechanical compression joints.** Compression gaskets shall conform to ASTM C 464. Gaskets shall be compressed when the pipe is fully inserted.

7.3.16.3 **Mechanical joints coupling.** Mechanical joint couplings for above-ground use shall have an electrometric sealing sleeve that conforms to ASTM C 564 or CAN/CSA B602 and shall be provided with a center stop. Underground mechanical couplings shall be installed in accordance with the manufacturer's instructions.

7.3.17 **Concrete pipe.** Joints between concrete pipe or fittings shall be made by the use of an electrometric seal conforming to ASTM C 443, ASTM C 1173, CAN/CSA A257.3M or CAN/CSA B602.

7.3.18 **Copper or copper-alloy tubing.** Joints between copper or copper-alloy tubing or fittings shall be in accordance with Sections 7.3.18.1 and 7.3.18.2.

7.3.18.1 **Mechanical Joints.** Mechanical joints shall be installed in accordance with the manufacturer's instructions.

7.3.18.2 **Soldered joints.** All joint surfaces shall be cleaned. A flux conforming to ASTM B 813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32.

7.3.19 **Polyethylene plastic pipe and tubing.** Joints between polyethylene plastic pipe and tubing or fittings shall be in accordance with Sections 7.3.19.1 and 7.3.19.2.

7.3.19.1 **Heat-fusion joints.** Joints surfaces shall be clean and free from moisture. All Joint surfaces shall be heated to melting temperature and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D 2657.

7.3.19.2 **Mechanical joints.** Mechanical joints shall be installed in accordance with the manufacture's instructions.

7.3.20 **PVC plastic pipe.** Joints between polyvinyl chloride (PVC) plastic pipe and fittings shall be in accordance with Sections 7.3.20.1 and 7.3.20.2.

7.3.20.1 **Mechanical joints.** Mechanical joints shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CAN/CSA B602. Joints shall be installed in accordance with the manufacturer's instructions.

7.3.20.2 **Solvent cementing.** Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA B137.3, CSA B181.2 or CSA B181.2 or CSA B182. I shall be applied to all joint surfaces. The joint shall be made while the cement is wet, and shall be in accordance with ASTM D 2855.

7.3.21 **Vitrified clay pipe.** Joints between vitrified clay pipe or fittings shall be made by the use of an electrometric seal conforming to ASTM C 425, ASTM C 1173 or CAN/CSA B602.

7.3.22 **Different piping materials.** Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type, or as permitted in sections 7.3.22.1 and 7.3.22.2 Connectors or adapters shall have an elastomeric seal conforming to ASTM C415, ASTM C443, ASTM C564, ASTM C 1173, ASTM D 1869, ASTM F 477, CAN/CSA A257.3M or CAN/CSA B602. Joints shall be installed in accordance with the manufacturer's instructions.

7.3.22.1 **Copper or copper-alloy tubing to cast-iron hub pipe.** Joints between copper or copper-alloy tubing and cast iron hub pipe shall be made with a brass ferrule or compression joint. The copper or copper-alloy tubing shall be soldered to the ferrule in an approved manner, and the ferrule shall be joined to the cast-iron hub by a caulked joint or a mechanical compression joint.

7.3.22.2 **Plastic pipe or tubing to other piping material.** Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting. Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a mechanical compression joint.

7.3.23 **Pipe installation.** Pipe shall be installed in accordance with these requirements SBC 701.

7.3.24 **Prohibited joints and connections.** The following types of joints and connections shall be prohibited:

1. Cement of concrete joints.
2. Mastic or hot-pour bituminous joints.
3. Joints made with fittings not approved for the specific installation.
4. Joints between different diameter pipes made with electrometric rolling O-rings.
5. Solvent-cement joints between different types of plastic pipe.

SECTION 7.4
SOIL ABSORPTION SYSTEMS

7.4.1 **Scope.** The provisions of this chapter shall govern the sizing and installation of soil absorption systems.

7.4.2 **Disposal of septic tanks Effluent.** Effluent from septic tanks and other approved treatment tanks shall be disposed of by soil absorption or an approved manner.

7.4.3 **Method of discharge.** Flow from the septic or treatment tank to the soil absorption system shall be by gravity or dosing for facilities with a daily effluent application of 5.5 m^3 or less. The tank effluent shall be discharged by pumping or

an automatic siphon for systems over 5.5 m^3.

7.4.4 **Sizing**. Sizing shall be in accordance with this chapter for systems with a daily effluent application of 19 m^3 or less. Two systems of equal size shall be required for systems receiving effluents exceeding 19 m^3 per day. Each system shall have a minimum capacity of 75 percent of the area required for a single system. An approved means of alternating waste application shall be provided. A dual system shall be considered as one system.

7.4.5 **Residential sizing.** The bottom area for seepage trenches or beds or the sidewall area for seepage pits required for a soil absorption system serving residential property shall be determined from Table 7.4.5 using soil percolation test data and type of construction.

TABLE 7.4.5
MINIMUM ABSORPTION AREA FOR ONE- AND TWO-FAMILY DWELLINGS

PERCOLATION CLASS	PERCOLATION RATE (MINUTES REQUIRED FOR WATER TO FALL 25 mm)	SEEPAGE TRENCHES OR PIT (SQUARE METER PER BEDROOM)	SEEPAGE BEDS (SQUARE METER PER BEDROOM)
1	0 to less than 10	15	19
2	10 to less than 30	23	29
3	30 to less than 45	28	35
4	45 to 60	30	38

7.4.6 **Other building sizing.** The minimum required soil absorption system area for all occupancies, except one- and two-family dwellings, shall be based on building usage, the percolation rate and system design in accordance with Tables 7.4.6(1) and 7.4.6(2). The minimum soil absorption area shall be calculated by the following equation:

$$A = U \times CF \times AA \qquad \textbf{7.4.6.1}$$

Where:

A = Minimum system absorption area.
AA = Absorption area from Table 7.4.6 (1).
CF = Conversion factor from Table 7.4.6 (2).
U = Number of units.

TABLE 7.4.6(1)
MINIMUM ABSORPTION AREA FOR
OTHER THAN ONE- AND TWO-FAMILY DWELLINGS

PERCOLATION CLASS	PERCOLATION RATE (MINUTES REQUIRED FOR WATER TO FALL 25 mm)	SEEPAGE TRENCHES OR PIT (SQUARE METER PER BEDROOM)	SEEPAGE BEDS (SQUARE METER PER BEDROOM)
1	0 to less than 10	10	13
2	10 to less than 30	15	19
3	30 to less than 45	20	23
4	45 to 60	20	26

TABLE 7.4.6(2)
CONVERSION FACTOR

BUILDING CLASSIFICATION	UNITS	FACTOR
Apartment building	1 per bedroom	1.5
Assembly hall—no kitchen	1 per person	0.02
Auto washer (service buildings, etc.)	1 per machine	6.0
Cocktail lounge	1 per patron space	0.2
Beauty salon	1 per station	2.4
Bowling center	1 per bowling lane	2.5
Bowling center with cafeteria or coffee shop	1 per bowling lane	4.5
Camp, day and night	1 per person	0.45
Camp, day use only	1 per person	0.2
Campground and camping resort	1 per camping space	0.9
Campground and sanitary dump station	1 per camping space	0.085
Car wash	1 per car	1.0
Catch basin—garages, motor fuel-dispensing facility, etc.	1 per basin	2.0
Catch basin—truck wash	1 per truck	5.0
Masjid	1 per person	0.5
Condominium	1 per bedroom	1.5
Dining or wedding hall—kitchen and toilet	1 per meal served	0.2
Dining or wedding hall—kitchen and toilet waste with dishwasher	1 per meal served	0.25
Drive-in restaurant, inside seating	1 per seat	0.3
Drive-in restaurant, without inside seating	1 per car space	0.3
Employees—in all buildings	1 per person	0.4
Floor drain	1 per drain	1.0
Hospital	1 per bed space	2.0
Hotel or motel and tourist rooming house	1 per room	0.9
Labor camp—central bathhouse	1 per employee	0.25
Medical office buildings, clinics and dental offices: Doctors, nurses and medical staff Office personnel Patients	 1 per person 1 per person 1 per person	 0.8 0.25 0.15
Mobile home park	1 per mobile home site	3.0
Motor fuel-dispensing facility	1 per car served	0.15
Nursing or group homes	1 per bed space	1.0
Outdoor sports facility—toilet waste only	1 per person	0.35
Park—showers and toilets	1 per acre	8.0
Park—toilet waste only	1 per acre	4.0
Restaurant—dishwasher	1 per seating space	0.15
Restaurant—kitchen and toilet	1 per seating space	0.6
Restaurant—kitchen waste only	1 per seating space	0.18
Restaurant—toilet waste only	1 per seating space	0.42
Restaurant—(24-hour) kitchen and toilet	1 per seating space	1.2
Retail store	1 per customer	0.03
School—meals and showers	1 per classroom	8.0
School—meals served or showers	1 per classroom	6.7
School—no meals, no showers	1 per classroom	5.0
Self-service laundry—toilet wastes only	1 per machine	1.0
Showers—public	1 per shower	0.3
Swimming pool bathhouse	1 per person	0.2

7.4.7 Installation

7.4.7.1 **Seepage trench excavations.** Seepage trench excavations shall be 0.3 m to 1.5 m wide. Trench excavations shall be spaced a minimum of 1.8 m apart. The absorption area of a seepage trench shall be computed by using only the bottom of the trench area. The bottom excavation area of the distribution header shall not be computed as absorption area. Individual seepage trenches shall be a maximum of 30 m long, unless otherwise approved.

7.4.7.2 **Seepage bed excavations.** Seepage bed excavations shall be a minimum of 1.5 m wide and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced a maximum of 1.5 m and a minimum of 0.9 m apart, and a maximum of 0.9 m and a minimum of 0.3 m from the sidewall or headwall.

7.4.7.3 **Seepage pits.** A seepage pit shall have a minimum inside diameter of 1.5 m and shall consist of a chamber walled-up with material, such as perforated precast concrete ring, concrete block, brick or other approved material allowing effluent to percolate into the surrounding soil. The pit bottom shall be left open to the soil. Aggregate of 12.5 mm to 65 mm in size shall be placed into a 150 mm annular space separating the outside wall of the chamber and sidewall excavation. The depth of the annular space shall be measured from the inlet pipe to the bottom of the chamber. Each seepage pit shall be provided with a 0.6 m manhole extending to within 1.4 m of the ground surface and a 100 mm-diameter fresh air inlet. Seepage pits shall be located a minimum of 1.5 m apart. Excavation and scarifying shall be in accordance with Section 7.4.7.4. The effective area of a seepage pit shall be the vertical wall area of the walled-up chamber for the depth below the inlet for all strata in which the percolation rates are less than 30 minutes per 25 mm. The 150 mm annular opening outside the vertical wall area is permitted to be included for determining the effective area. Table 7.4.7.3, or an approved method, shall be used for determining the effective sidewall area of circular seepage pits.

TABLE 7.4.7.3
EFFECTIVE SQUARE-METER ABSORPTION AREA FOR SEEPAGE PITS

INSIDE DIAMETER OF CHAMBER IN METER PLUS 0.3 M FOR WALL THICKNESS PLUS 0.3 M FOR ANNULAR SPACE	DEPTH IN METER OF PERMEABLE STRATA BELOW INLET					
	1.0	1.25	1.5	1.75	2.0	2.5
2.0	6.28	7.85	9.42	11.00	12.57	15.71
2.5	7.85	9.82	11.78	13.74	15.71	19.63
2.75	8.64	10.80	12.96	15.12	17.28	21.60
3.0	9.42	11.78	14.14	16.49	18.85	23.56
3.5	11.00	13.74	16.49	19.24	21.99	27.49
4.0	12.57	15.71	18.85	21.99	25.13	31.42

7.4.7.4 **Excavation and construction.** The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose

material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

7.4.5.5 **Aggregate and backfill.** A minimum of 0.15 m of aggregate ranging in size from 12.5 mm to 65 mm shall be laid into the trench or bed below the distribution pipe elevation. The aggregate shall be evenly distributed a minimum of 0.05 m over the top of the distribution pipe. The aggregate shall be covered with approved synthetic materials or 0.25 m of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. A minimum of 0.45 m of soil backfill shall be provided above the covering.

7.4.7.6 **Distribution piping.** Distribution piping for gravity systems shall be not less than 100 mm in diameter. The distribution head (PVC) shall be solid-wall pipe. The top of the distribution pipe shall be not less than 0.2 m below the original surface in continuous straight or curved lines. The slope of the distribution pipes shall be 1.5 mm to 3.5 mm per 1 m. Effluent shall be distributed to all distribution pipes. Distribution of effluent to seepage trenches on sloping sites shall be accomplished by utilizing a drop box design or other approved methods. Where dosing is required, the siphon or pump shall discharge a dose of minimum capacity equal to 75 percent of the combined volume of the distribution piping in the absorption system.

7.4.7.7 **Observation pipes.** Observation pipes shall be provided. Such pipes shall be not less than 100 mm in diameter, not less than 0.3 m above final grade and shall terminate with an approved vent cap. The bottom 0.3 m of the observation pipe shall be perforated and extend to the bottom of the aggregate. Observation pipes shall be located at least 7.5 m from any window, door or air intake of any building used for human occupancy. A maximum of four distribution pipelines shall be served by one common 100 mm observation pipe when interconnected by a common header pipe.

Exception: Where approved and where the location of the observation pipe is permanently recorded, the observation pipe shall be not more than 50 mm below the finished grade.

7.4.7.8 **Winter installation.** Soil absorption systems shall not be installed during periods of adverse weather conditions unless approved. A soil absorption system shall not be installed where the soil at the system elevation is frozen. Snow cover shall be removed from the soil absorption area before excavation begins. Snow shall not be placed in a manner that will cause water to pond on the soil absorption system area during snow melt. Excavated soil to be used as backfill shall be protected from freezing. Excavated soil that freezes solid shall not be used as backfill. The first 0.3 m of backfill shall be loose, unfrozen soil. Inspection of systems installed during winter conditions shall include inspection of the trench or bed excavation prior to the placement of gravel and inspection of backfill material at the time of placement.

7.4.7.9 **Evaporation.** Soil absorption systems shall not be covered or paved over by material that inhibits the evaporation of the effluent.

SECTION 7.5
TANKS

7.5.1 **Scope.** The provisions of this chapter shall govern the design, installation, repair and maintenance of septic tanks, treatment tanks and holding tanks.

7.5.2 Septic tanks and other treatment tanks.

7.5.2.1 **General.** Septic tanks shall be fabricated or constructed of welded steel, monolithic concrete, fiberglass or an approved material. Tanks shall be water tight and fabricated to constitute an individual structure and shall be designed and constructed to withstand anticipated loads. The design of prefabricated septic tanks shall be approved. Plans for site-constructed concrete tanks shall be approved prior to construction.

7.5.2.2 **Design of septic tanks.** Septic tanks shall have not less than two compartments. The inlet compartment shall be not less than two-thirds of the total capacity of the tank, not less than a 1.9 m^3 liquid capacity and not less than 0.9 m wide and 1.5 m long. The secondary compartment of a septic tank shall have not less than a capacity of 0.95 m^3 and not more than one-third of the total capacity. The secondary compartment of septic tanks, having a capacity more than 5.65 m^3, shall be not less than 1.5 m long.

The liquid depth shall be not less than 0.75 m and a maximum average of 1.8 m. The total depth shall be not less than 0.2 m greater than the liquid depth.

Rectangular tanks shall be constructed with the longest dimensions parallel to the direction of the flow.

Cylindrical tanks shall be not less than 1200 mm in diameter.

7.5.2.3 **Inlets and outlets.** The inlet and outlet on all tanks or tank compartments shall be provided with open-end coated sanitary tees or baffles made of approved materials constructed to distribute flow and retain scum in the tank or compartments. The inlet and outlet openings on all tanks shall contain a stop or other provision that will prevent the insertion of the sewer piping beyond the inside wall of the tank. The tees or baffles shall extend a minimum of 0.15 m above and 0.2 m below the liquid level, but shall not exceed one-third the liquid depth. A minimum of 0.05 m of clear space shall be provided over the top of the baffles or tees. The bottom of the outlet opening shall be a minimum of 0.05 m lower than the bottom of the inlet.

7.5.2.4 **Manholes.** Each compartment of a tank shall be provided with at least one manhole opening located over the inlet or outlet opening, and such opening shall be not less than 0.6 m square or 600 mm in diameter. Where the inlet compartment of a septic tank exceeds 3.65 m in length, an additional manhole shall be provided over the baffle wall. Manholes shall terminate a maximum of 0.15 m below the ground surface and be of the same material as the tank. Steel tanks shall have not less than a 0.05 m collar for the manhole extensions permanently welded to the tank. The manhole extension on fiberglass tanks shall be of the same material as the tank and an integral part of the tank. The collar shall be not less than 0.05 m in height.

7.5.2.5 **Manhole covers.** Manhole risers shall be provided with a fitted, water-tight cover of concrete, steel, cast iron or other approved material capable of withstanding all anticipated loads. Manhole covers terminating above grade shall have an approved locking device.

7.5.2.6 **Inspection opening.** An inspection opening shall be provided over either the inlet or outlet baffle of every treatment tank. The opening shall be not less than 100 mm in diameter with a tight-fitting cover. Inspection pipes terminating above ground shall be not less than 0.15 m above finished grade. Inspection pipes approved for terminating below grade shall be not more than 0.05 m below finished grade, and the location shall be permanently recorded.

7.5.2.7 **Capacity and sizing.** The capacity of a septic tank or other treatment tank shall be based on the number of persons using the building to be served or on the volume and type of waste, whichever is greater. The minimum liquid capacity shall be 2.85 m^3. Where the required capacity is to be provided by more than one tank, the

minimum capacity of any tank shall be 2.85 m^3. The installation of more than four tanks in series shall be prohibited.

7.5.2.7.1 **Sizing of tank.** The minimum liquid capacity for one- and two-family dwellings shall be in accordance with Table 7.5.2.7.1.

TABLE 7.5.2.7.1
SEPTIC TANK CAPACITY FOR
ONE- AND TWO-FAMILY DWELLINGS

NUMBER OF BEDROOMS	SEPTIC TANK (m^3)
1	2.85
2	2.85
3	3.75
4	4.55
5	5.40
6	6.25
7	7.10
8	7.95

7.5.2.7.2 **Other buildings.** For buildings, the liquid capacity shall be increased above the 2.85-m^3 minimum as established in Table 7.5.2.7.1. In buildings with kitchen or laundry waste, the tank capacity shall be increased to receive the anticipated volume for a 24-hour period from the kitchen or laundry or both. The liquid capacities established in Table 7.5.2.7.2 do not include employees.

Exception: One- or two-family dwellings.

TABLE 7.5.2.7.2
ADDITIONAL CAPACITY FOR OTHER BUILDINGS

BUILDING CLASSIFICATION	CAPACITY (m^3)
Apartment buildings (per bedroom—includes automatic clothes washer)	0.57
Assembly halls (per person—no kitchen)	0.01
Beauty salons (per station—includes customers)	0.53
Bowling centers (per lane)	0.47
Camp, day use only—no meals served (per person)	0.06
Campgrounds and camping resorts (per camp space)	0.38
Campground sanitary dump stations (per camp space) (omit camp spaces with sewer connection)	0.02
Camps, day and night (per person)	0.15
Car washes (per car hand wash)	0.19
Catch basins—garages, motor fuel-dispensing facilities, etc. (per basin)	0.38
Catch basins—truck washing (per truck)	0.38
Masajed (per person)	0.05
Condominiums (per bedroom—includes automatic clothes washer)	0.57
Dining or wedding halls—kitchen and toilet waste—with dishwasher (per meal served)	0.04
Dining or wedding halls—kitchen waste only (per meal served)	0.01
Drive-in restaurants—all paper service (per car space)	0.06
Drive-in restaurants—all paper service, inside seating (per seat)	0.06
Employees—in all buildings, per employee—total all shifts	0.08
Floor drains (per drain)	0.19
Hospitals (per bed space)	0.76
Hotels or motels and tourist rooming houses	0.38
Labor camps, central bathhouses (per employee)	0.11
Medical office buildings, clinics and dental offices:	
Doctors, nurses, medical staff (per person)	0.28
Office personnel (per person)	0.08
Patients (per person)	0.04
Mobile home parks, homes with bathroom groups (per site)	1.14
Motor fuel-dispensing facilities	0.04
Nursing and rest homes—without laundry (per bed space)	0.38
Outdoor sports facilities (toilet waste only—per person)	0.02
Parks, toilet wastes (per person—75 persons per acre)	0.02
Parks, with showers and toilet wastes (per person—75 persons per acre)	0.04
Restaurants—dishwasher (per seat)	0.01
Restaurants—kitchen and toilet wastes (per seating space)	0.11
Restaurants—kitchen waste only—without dishwasher (per seat)	0.03
Restaurants—toilet waste only (per seat)	0.08
Restaurants (24-hour)—dishwasher (per seat)	0.02
Restaurants (24 hour)—kitchen and toilet wastes (per seating space)	0.23
Retail stores—customers	0.01
Schools (per classroom—25 pupils per classroom)	1.70
Schools with meals served (per classroom—25 pupils per classroom)	2.27
Schools with meals served and showers provided (per classroom)	2.84
Self-service laundries (toilet waste only, per machine)	0.19
Automatic clothes washers (apartments, service buildings, etc.—per machine)	1.14
Showers—public (per shower taken)	0.06
Swimming pool bathhouses (per person)	0.04

7.5.2.8 **Installation.** Septic and other treatment tanks shall be located with a horizontal distance not less than specified in Table 7.5.2.8 between various elements. Tanks installed in ground water shall be securely anchored. A 75-mm-thick compacted bedding shall be provided for all septic and other treatment tank installations. The

bedding material shall be sand, gravel, granite, lime rock or other non-corrosive materials of such size that the material passes through a 12.5 mm screen.

TABLE 7.5.2.8
MINIMUM HORIZONTAL SEPARATION DISTANCES FOR TREATMENT TANKS

ELEMENT	DISTANCE (m)
Building	1.50
Cistern	7.60
Foundation wall	1.50
Lot line	0.60
Pond	7.60
Reservoir	7.60
Stream or watercourse	7.60
Swimming pool	4.60
Water service	1.50
Well	7.60

7.5.2.9 **Backfill.** The backfill material for steel and fiberglass tanks shall be specified for bedding and shall be tamped into place without causing damage to the coating. The backfill for concrete tanks shall be soil material, which shall pass a 100 mm screen and be tamped into place.

7.5.2.10 **Manhole riser joints.** Joints on concrete risers and manhole covers shall be tongue-and-groove or shiplap type and sealed water tight using neat cement, mortar or bituminous compound. Joints on steel risers shall be welded or flanged and bolted and water tight. Steel manhole extensions shall be bituminous coated both inside and outside. Methods of attaching fiberglass risers shall be water tight and approved.

7.5.2.11 **Dosing or pumping chambers.** Dosing or pumping chambers shall be fabricated or constructed of welded steel, monolithic concrete, glass-fiber reinforced polyester or other approved materials. Manholes for dosing or pumping chambers shall terminate not less than 100 mm above the ground surface. Dosing or pumping chambers shall be water tight, and materials and construction specifications shall meet the same criteria specified for septic tanks in this chapter.

7.5.2.11.1 **Capacity sizing.** The working capacity of the dosing or pumping chamber shall be sized to permit automatic discharge of the total daily sewage flow with discharge occurring not more than four times per 24 hours. Minimum capacity of a dosing chamber shall be 1.9 m^3 and a space shall be provided between the bottom of the pump and floor of the dosing or pumping chamber. A dosing chamber shall have a 1-day holding capacity located above the high-water alarm for one- and two-family dwellings based on 0.38 m^3 per day per bedroom, or in the case of other buildings, in accordance with Section 7.5.2.7. Minimum pump chamber sizes are indicated for one- and two-family dwellings in Table 7.5.2.11.1. Where the total developed length of distribution piping exceeds 300 m, the dosing or pumping chamber shall be provided with two siphons or pumps dosing alternately and serving one-half of the soil absorption system.

7.5.2.12 **Design of other treatment tanks.** The design of other treatment tanks shall be approved on an individual basis. The capacity, sizing and installation of the tank

shall be in accordance with this section unless otherwise approved. Where a treatment tank is preceded by a conventional septic tank, credit shall be given for the capacity of the septic tank.

TABLE 7.5.2.11.1
PUMP CHAMBER SIZES

NUMBER OF BEDROOMS	MINIMUM PUMPING CHAMBER SIZE (m^3)
1	1.9
2	1.9
3	2.85
4	2.85
5	3.75

7.5.3 **Maintenance.** Septic tanks and other treatment tanks shall be cleaned whenever the sludge and scum occupy one-third of the tank's liquid capacity.

7.5.4 **Septage disposal.** All septage (sludge) shall be disposed at an approved location.

7.5.5 **Chemical restoration.** Products for chemical restoration or chemical restoration procedures for private sewage disposal systems shall not be utilized unless approved.

7.5.6 **Holding tanks.**

7.5.6.1 **Approval.** The installation of a holding tank shall not be approved where the site can accommodate the installation of any other private sewage disposal system specified in these requirements SBC 701. A pumping and maintenance schedule for each holding tank installation shall be submitted to the code official.

7.5.6.2 **Sizing.** The minimum liquid capacity of a holding tank for one- and two-family dwellings shall be in accordance with Table 7.5.6.2. Other buildings shall have a minimum 5-day holding capacity, but not less than 7.55 m^3. Sizing shall be in accordance with Table 7.5.2.7.2. Not more than four holding tanks shall be installed in series.

TABLE 7.5.6.2
MINIMUM LIQUID CAPACITY OF HOLDING TANKS

NUMBER OF BEDROOMS	TANK CAPACITY (m^3)
1	7.55
2	7.55
3	7.55
4	9.45
5	11.35
6	13.25
7	15.15
8	17.00

7.5.6.3 **Construction.** Holding tanks shall be constructed of welded steel, monolithic concrete, glass-fiber reinforced polyester or other approved materials.

7.5.6.4 **Installation.** Tanks shall be located in accordance with Section 7.5.2.8, except the tanks shall be not less than 6.0 m from any part of a building. Holding tanks shall be located so the servicing manhole is located not less than 3.0 m from an all-weather access road or drive.

7.5.6.5 **Warning device.** A high-water warning device shall be installed to activate 0.3 m below the inlet pipe. This device shall be either an audible or an approved illuminated alarm. The electrical junction box, including warning equipment junctions, shall be located outside the holding tank or housed in water-proof, explosion-proof enclosures. Electrical relays or controls shall be located outside the holding tank.

7.5.6.6 **Manholes.** Each tank shall be provided with either a manhole not less than 600 mm square or a manhole with a 600 mm inside diameter extending not less than 0.10 m above ground. Finish grade shall be sloped away from the manhole to divert surface water from the manhole. Each manhole cover shall have an effective locking device. Service ports in manhole covers shall be not less than 200 mm in diameter and shall be 0.10 m above finished grade level. The service port shall have an effective locking cover or a brass cleanout plug.

7.5.6.7 **Septic tank.** The outlet shall be sealed where an approved septic tank is installed to serve as a holding tank. Removal of the inlet and outlet baffle shall not be prohibited.

7.5.6.8 **Vent.** Each tank shall be provided with a vent not less than 50 mm in diameter and shall extend not less than 0.30 m above finished grade, terminating with a return bend fitting or approved vent cap.

SECTION 7.6
CESSPOOLS

7.6.1 **Scope.** The provisions of this chapter shall govern the design and installation of cesspools.

7.6.2 **Application.** Cesspools shall not be installed, except where approved by the code official. A cesspool shall be considered only as a temporary expedient pending the construction of a public sewer; as an overflow facility where installed in conjunction with an existing cesspool; or as a means of sewage disposal for limited, minor or temporary applications.

7.6.3 **Construction.** Cesspools shall conform to the construction requirements of Section 7.4.7.3 for seepage pits. The seepage pit shall have a minimum sidewall of 6 m below the inlet opening. Where a strata of gravel or equally pervious material of 1.2 m or more in thickness is found, the sidewall need not be more than 3 m below the inlet.

SECTION 7.7
INSPECTIONS

7.7.1 **Scope.** The provisions of this chapter shall govern the inspection of private sewage disposal systems.

7.7.2 **Initial inspection procedures.** All private sewage disposal systems shall be inspected after construction, but before backfilling. The code official shall be notified when the private sewage disposal system is ready for inspection.

7.7.3 **Preparation for inspection.** The installer shall make such arrangements as will enable the code official to inspect all parts of the system when a private sewage disposal system is ready. The installer shall provide the proper apparatus and equipment for conducting the inspection and furnish such assistance as is necessary to conduct the inspection.

7.7.4 **Covering of work.** A private sewage disposal system or part thereof shall not be backfilled until such system has been inspected and approved. Any system that has been covered before being inspected and approved shall be uncovered as required by the code official.

7.7.5 **Other inspections.** In addition to the required inspection prior to backfilling, the code official shall conduct any other inspections deemed necessary to determine compliance with these code requirements SBC 701.

7.7.6 **Inspections for additions, alterations or modifications.** Additions, alterations or modifications to private sewage disposal systems shall be inspected.

7.7.7 **Defects in materials and workmanship.** Where inspection discloses defective material, design or siting or unworkmanlike construction not conforming to these requirements SBC 701, the nonconforming parts shall be removed, replaced and reinspected.

REFERENCED STANDARDS

These are the standards referenced within SBC 701. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title. The application of the referenced standards shall be as specified in SBC.

1. ANSI, Z4.3—95, Minimum Requirements for Nonsewered Waste-Disposal Systems, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
2. ANSI, Z21.22—99, Relief Valves for Hot Water Supply Systems, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
3. ANSI, Z124.1—95, Plastic Bathtub Units, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
4. ANSI, Z124.2—95 Plastic Shower Receptors and Shower Stalls, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
5. ANSI, Z124.3—95, Plastic Lavatories, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
6. ANSI, Z124.4—96, Plastic Water Closet Bowls and Tanks, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
7. ANSI, Z124.6—97, Plastic Sinks, American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
8. ARI, 1010—94, Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers, Air-Conditioning & Refrigeration Institute, 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203.
9. ASME, A112.1.2—1991(R1998), Air Gaps in Plumbing Systems, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
10. ASME, A112.1.3—2000, Air Gap Fittings for Use with Plumbing Fixtures, Appliances and Appurtenances, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
11. ASME, A112.3.1—1993, Performance Standard and Installation Procedures for Stainless Steel Drainage Systems or Sanitary, Storm and Chemical Applications, Above and Below Ground, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
12. ASME, A112.3.4—2000, Macerating Toilet Systems and Related Components, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
13. ASME, A112.4.1—1993(R1998), Water Heater Relief Valve Drain Tubes, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
14. ASME, A112.4.3—1999, Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
15. ASME, A112.6.1M—1997, Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
16. ASME, A112.6.2—2000, Framing-Affixed Supports for Off-the-Floor Water Closets with Concealed Tanks, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
17. ASME, A112.6.3—2001, Floor and Trench Drains, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
18. ASME, A112.6.7—2001, Enameled and Epoxy-coated Cast-iron and PVC plastic Sanitary Floor Sinks, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
19. ASME, A112.14.1—1975(R1998), Backwater Valves, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
20. ASME, A112.14.3—2000, Grease Interceptors, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
21. ASME, A112.14.4—2001, Grease Removal Devices, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

22. ASME, A112.18.1—2000, Plumbing Fixture Fittings, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
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232. CISPI, 301—00, Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications, Cast Iron Soil Pipe Institute, 5959 Shallowford Road, Suite 419, Chattanooga, TN 37421.
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